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PATENT ABSTRACTS OF JAPAN

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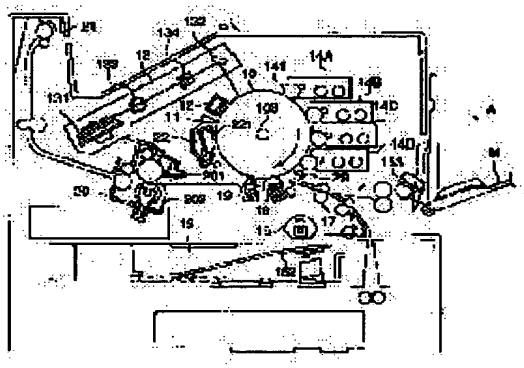
(71)Applicant : KONICA CORP
(72)Inventor : HORIUCHI TATSUMI

(54) LINE WIDTH CONTROL METHOD

(57)Abstract:
PURPOSE: To control the line width of a toner line image to be specified line width by detecting an inflection point in the inclination of reflection density from a toner line image and a patch image by using an index signal and adjusting the condition of an electrophotographic process from data at the inflection point.
CONSTITUTION: An MPU performs line width measuring processing continuously to the deciding operation of the revolving speed of a developing sleeve 141. Namely, the MPU measures printing density in order to obtain excellent printing quality and resets it to an initial value, continuously sets a line pitch at the initial value to successively change a PWM value, obtains the inflection point, and recognizes the inflection point to be that the line width of the toner image and the pitch are equal. The MPU calculates the inclination to pulse width used for forming the patch image to obtain image density. Then, the MPU calculates the optimum pulse width from the obtained inflection point. The calculating accuracy of the inflection point depends only on the index signal for controlling the operation timing of a write means 13.



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CLAIMS

[Claim(s)]
[Claim 1] A line breadth control method characterized by providing the following A pulse width control process of adjusting a pulse width signal which controls luminescence of the light source A patch latent-image formation process which forms a patch latent image which consists of two or more line latent images by irradiating light from said light source A **** process which develops said patch latent image in a patch image which consists of a toner line image A process which forms two or more patch images with which a **** process is repeated from said pulse width control process, and gradation differs, a process which measures optical density of said patch image, a point-of-inflection detection process of detecting point of inflection in ** of reflection density using an index signal from said toner line image and patch image, and a process condition adjustment process of adjusting conditions of an electrophotography process from data in said point of inflection
[Claim 2] Said patch image is the line breadth control method according to claim 1 characterized by piling up two or more colors.
[Claim 3] Said patch image is the line breadth control method according to claim 1 or 2 characterized by changing a gap, seting line breadth of a toner line image as constant.
[Claim 4] Said patch image is the line breadth control method according to claim 1 or 2 characterized by changing line breadth of a toner line image.
[Claim 5] Magnitude of said patch image is the line breadth control method according to claim 1 or 2 characterized by having made it larger than measuring range of a sensor.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the line breadth control method of adjusting the line breadth of the line line image reproduced in an electrophotography process to predetermined width of face.
[0002]
[Description of the Prior Art] In the image formation equipment which adopts an electrophotography process, the reproduced line image changes the concentration and line breadth of an image with the temperature of image environment, humidity, image support, the use counts of a developer, etc. In the image formation equipment which forms a toner image by reversal development on image support, the phenomenon of changing the width of face of a linear toner image is explained with reference to drawing 12 .
[0003] Drawing 12 is a mimetic diagram explaining the phenomenon of changing the width of face of a linear toner image. Drawing 12 (a) VZ which - (e) takes potential along an axis of ordinate, and length is shown on a horizontal axis, shows the concentration and line breadth of a toner image typically by this, and is shown according to a two-dot chain line shows rest potential. Drawing 12 (a) is the mimetic diagram showing the latent image which carried out image exposure and formed image support after being charged. Drawing 12 (b) shows the portion equivalent to toner coating weight, when the latent image shown in drawing 12 (a) is developed, and the dotted line shows the surface potential of a toner. Drawing 12 (c) is the mimetic diagram showing the latent-image potential at the time of going up from the initial state which rest potential Vz showed to drawing 12 (a) by repeat activity. The alternate long and short dash line in drawing 12 (d) shows the portion equivalent to the toner coating weight when developing the latent image shown in drawing 12 (c). Although it is hardly different from the line breadth of the toner image shown in this field sign 12 (b), it is shown that image concentration falls. Although what controlled and developed development conditions shows by the dotted line and shows that image concentration can be made the same in order to amend lowering of this image concentration, it is shown that line breadth increases. Although there is no change in the maximum image concentration when drawing 12 (e) shows the condition with the loose gamma characteristics of the sensitization layer of image support of having carried out direction change and develops it under these conditions, it is shown that line breadth becomes narrow.
[0004] In order to suppress change of the image concentration and line breadth which were mentioned above, an environmental temperature and humidity are measured, and when temperature is high, detecting and feeding back the line breadth and image concentration of a toner image etc. is performed by measuring amendment of setting up electrification potential more highly, and the reflection density of a toner patch. For this line breadth measurement means, a direct measurement method and an indirect-measurement method can be considered.
[0005] Drawing 10 is the block diagram showing a line breadth measurement means to measure the line breadth of a toner image directly.
[0006] The line breadth measurement means of this direct measurement method can consider detecting the line breadth of a toner image by having the image formation lens L2 which expands and carries out image formation of the light which reflects the light from the light source P from the image formation lens L1 which carries out image formation to the image support Z, and the toner image TG which supported to the image support Z to a photo detector LS, and counting the output signal from a photo detector LS.
[0007] Drawing 11 is the block diagram showing a line breadth measurement means to measure the line breadth of a toner image indirectly.
[0008] The line-breadth measurement means of this indirect-measurement method is equipped with the image-formation lens L3 which reduces and carries out image formation of the light which reflects the light from the light source P from the image-formation lens L1 which carries out image formation to the image support Z, and the toner image TG which supported to the image support Z to a photo detector PD, regards the front face of image support as change of wrap coverage, and detects it as change of the amount of reflected lights by the photo detector PD which has a single light sensing portion. Since the photo detector PD adopted here has a single light sensing portion and it is sufficient for it, it becomes cheaper than a line breadth measurement means to measure direct radiation width of face as shown in drawing 10 .
[0009]
[Problem(s) to be Solved by the Invention] However, in spite of having fed back by amendment of the above-mentioned electrification potential, or measurement of the reflection density of a toner patch, since change of line breadth was as small as several micrometers to about 10 micrometers, there was nothing that can be measured

directly with cheap equipment. Since a line breadth measurement means as shown in drawing 10 will specifically need the line sensor formed in the pitch of about severalmicro per pixel in order to detect fluctuation of line breadth with a sufficient precision, and the scale factor of the optical system which consists of a photo detector L2 will need an about 10-time scale factor, it becomes cost high. If the focal distance of the above-mentioned optical system is set to 5mm, since the whole sensor serves as magnitude of 50mm or more, it becomes the magnitude which is hard to include in the image formation equipment in the inclination to miniaturize. On the other hand, since the line breadth measurement means explained with reference to drawing 11 will grasp the toner image as a gestalt for which two or more linear toner images gathered, it cannot distinguish and measure change of line breadth, and change of image concentration. Therefore, even if it adjusted development conditions etc. and has maintained image concentration to predetermined, since the output level from a photo detector PD was related to the line breadth of a toner image, an output will also change with an environmental variation, aging, dirt, etc., and it was not able to amend the error. Moreover, since an absolute precision of a sensor was required of any method, it did not have what can be used being able to incorporate in image formation equipment. Moreover, the circuit for driving a line sensor and the circuit which reads the output signal from a line sensor also become intricately and expensive.

[0010] The object of this invention is to offer the line breadth control method which controls the toner line image which detects the line breadth of a toner line image by several micrometers to about 10 micrometers, and is reproduced to predetermined line breadth in view of the above-mentioned trouble.

[0011]

[Means for Solving the Problem] There are the following as a means to attain the above-mentioned object.

[0012] (1) A pulse width control process of adjusting a pulse width signal which controls luminescence of the light source, A patch latent-image formation process which forms a patch latent image which consists of two or more line latent images by irradiating light from said light source, A **** process which develops said patch latent image in a patch image which consists of a toner line image, A process which forms two or more patch images with which a **** process is repeated from said pulse width control process, and gradation differs, and a process which measures optical density of said patch image, A line breadth control method which consists of a point-of-inflection detection process of detecting point of inflection in ** of reflection density using an index signal from said toner line image and patch image, and a process condition adjustment process of adjusting conditions of an electrophotography process from data in said point of inflection.

[0013] (2) Said patch image is the line breadth control method of of (1) characterized by piling up two or more colors.

[0014] (3) Said patch image is either line breadth control method of (1) and (2) characterized by changing a gap, seting line breadth of a toner line image as constant.

[0015] (4) Said patch image is either line breadth control method of (1) and (2) characterized by changing line breadth of a toner line image.

[0016] (5) Magnitude of said patch image is either line breadth control method of (1) and (2) characterized by making it larger than measuring range of a sensor, and having carried out.

[0017]

[Example] Drawing 1 is the outline block diagram showing the image formation equipment of this example, and drawing 5 is a graph which shows the potential property of the image support adopted as the image formation equipment of this example.

[0018] For every revolution of the image support 10, it is based on the electrification machine 12 and the image formation equipment of this example is charged, as shown in drawing 1 . The electrostatic latent image whose color was separated on the image support 10 by image exposure by write-in equipment 13 is formed. To the periphery of the image support 10 in order are full color and to reproduce the electrostatic latent image concerned Yellow, Make it operate selectively from the development counters 14A-14D which contained the two component developer which consists of a Magenta, cyanogen, and a black toner and a black carrier, respectively, and it develops in a toner image. By repeating a series of processes which form the toner image concerned in the image support 10 two or more times for every color, after bundling up with the imprint roller 18 to the imprint material sent from a sheet paper cassette 15 after piling up each color toner image on the image support 1 and imprinting to it, it is established with an anchorage device 20.

[0019] The main part housing of image formation equipment is formed from the upright side panel 1 (not shown) and the upright side panel 2 (not shown). The development unit 120 which stores two or more development counters 14A-14D with write-in equipment 13 and the image support 10 among side panels 1 and 2, Furthermore, an anchorage device 20 and a DC power supply unit (not shown) are incorporated. On the other hand, the control board (not shown) for operating-sequence control of a drive system, the formatter (not shown) which decodes a printer command, and a machine is stored in the outside of a side panel 2. Moreover, a toner makeup means 140 to connect with each development counters 14A-14D in the development unit 120 is held in the upper part of the development unit 120.

[0020] The image support 10, the electrification machine 12, and cleaning equipment 22 are incorporated and united with the drum cartridge 130 (not shown), and, on the other hand, each development counters 14A-14D and a toner makeup means (not shown) are incorporated and united with the stand 100 (not shown). A stand 100 is positioned in the location which can perform image formation actuation, or is equipped with the configuration for moving almost horizontally and setting it as the drawer location from the stowed position to the main part of equipment, as shown in drawing 1 .

[0021] The guide idler 53 (not shown) is provided so that each inner surface of a side panel 1 and a side panel 2 which forms the main part of equipment may be faced at a upper rail 51 (graphic display ****) and the lower rail 52 (not shown), and on the other hand, it has the plate-like part material 41 which equips the side of the right and left with the rotation roller 42, and the rotation roller 42 is engaged with the guide member 50, and a stand 100 engages plate-like part material 41 the very thing with a guide idler 53, respectively, and supports It is an outline configuration for attaining the function which this mentioned above.
[0022] Below, it is attached to the configuration and function of each part material, and explains.
[0023] The image support 10 on the conductive base material of phi 120 fabricated from the aluminum For example, coating of the under-coating layer of 0.3 micrometers of thickness is carried out with alcoholic fusibility polyimide. Apply the CGL agent which distributed the polyvinyl butyral for Y mold CHITARU phthalocyanine on the under-coating layer concerned, and coating of the CGL of 0.3 micrometers of thickness is carried out. It is the electrophotography photo conductor which carried out coating of the CTL of 25 micrometers of thickness which consists of a polycarbonate and a still triphenylamine system compound, and carried out the laminating of an interlayer and the sensitization layer on the CGL concerned, and has grounded. The encoder (not shown) is formed in the driving shaft 103 of the image support 10, and thereby, MPU210 detects the phase of the image support 10, and has been made to perform the electrophotography process.
[0024] Here, the potential property of the image support 10 is explained with reference to drawing 5 .
[0025] The surface potential (- V) of the image support 10 is shown on the axis of ordinate by the graph shown in drawing 5 , and the power (mW) of semiconductor laser is shown on the horizontal axis. O The potential property in 20-degree-C50%RH (this may be hereafter called ordinary temperature normal relative humidity NN) is shown, ** shows the potential property in 30-degree-C80%RH (this may be hereafter called high-humidity/temperature HH), and ** shows the potential property in 10-degree-C20%RH (it may be called low-humidity/temperature LL). This graph shows changing the surface potential in the exposure field of the image support 10 with environmental temperature humidity. Here, an exposure field means fields other than initial electrification potential.
[0026] The driving shaft 103 and the revolution of both the flanges 101,102 (not shown) that support image support 10 peripheral surface are enabled, and they form the spring member 105 between the holddown member 104 (not shown) fixed to the driving shaft 103, and one flange 101, and have connected each other with it. When it does in this way, an effect equivalent to having made low rigidity of a drive system which consists of image support 10 and a driving shaft 103 is acquired, a resonant frequency is lowered, and it can avoid resonating with fluctuation of the oscillation from a driver G. And fluctuation of the rotational speed inputted into the driving shaft 103 can be made to be able to absorb by the low rigidity member, and the image support 10 can be rotated, without producing fluctuation of 100 mm/sec linear velocity.
[0027] in order to abolish the hysteresis of the photo conductor to a front print in advance of negative electrification in which the image support 10 was stabilized according [PCL11] to the electrification machine 12 since revolution actuation is carried out by realizing the driving force transfer method with this configuration — light emitting diode etc. — using — exposure — carrying out — the sensitization layer peripheral surface of the image support 10 — discharging electricity . The electrification machine 12 gives uniform electrification of VH-850V by carrying out corona discharge to VG to the peripheral surface of the image support 10 from the corona discharge wire which consists of a grid by which potential maintenance was carried out, and a platinum wire (a clad or alloy).
[0028] Through the polygon mirror 131 and ftheta lens 133 grade which make the laser diode which is not illustrated based on a picture signal after being uniform charged to the sensitization layer of the image support 10 the luminescence light source, and rotate, write-in equipment 13 bends an optical path by the reflective mirror 132, scans, and forms a latent image by the revolution (vertical scanning) of the image support 10. That is, if the image data from a formatter is sent to a laser diode (LD) modulation circuit and a laser diode emits light with the modulated picture signal, the synchronization of each scanning line will be achieved by the beam index 136 (not shown) through a mirror 137 (not shown), and it will be projected on the beam light by the polygon mirror 131. The polygon mirror 131 reflects and scans beam light with the polyhedron, after, as for the scan light, a beam shape is amended by the ftheta lens 133 and the cylindrical lens 134, it exposes a photo conductor through the reflective mirror 132, performs horizontal scanning, and forms an electrostatic image. the polygon mirror 131 — a 6th page mirror — pneumatic bearing adoption of rotational frequency 23600rpm — it carries out. The focal distance of the ftheta lens 133 and cylindrical-lens 134 grade is f= 140mm. Dot clocks are 20MHZ(s). A beam diameter is about 140x100 micrometers. It is latent-image potential VL-50V of this beam diameter.
[0029] In order to obtain a high quality picture, it is necessary to also make particle size of a toner small. In this example, each color is using the toner with a size of 8 micrometers. However, for a user, black alphabetic character quality is the most important and the diameter toner of a granule (7 micrometers - 11 micrometers) is suitable for a black toner. thereby, the print density of image formation equipment also boils ******, it is 12 dot(s)/mm and the dot pitch may be 1/12mm.
[0030] The toner supplied from the toner box (not shown) falls at the right edge of a development counter, and churning mixing is carried out by the churning screw of the couple which rotates in the opposite direction with a carrier, and it is set as the predetermined amount (Q/M) of electrifications by it.
[0031] On the other hand, toner concentration is detected by L ******, controls the amount of supply of a toner based on this output frequency, and setting-out control is carried out at 5 thru/or about 7% of toner concentration value.
[0032] The agitated two component developer is conveyed by the development sleeve 141 through a feed roller 143,

it is made a thin layer by thickness specification-part material (not shown), is conveyed two times 20 to 30 mg/cm in the development region of the image support 10, and performs reversal development of an electrostatic latent image according to the development conditions described below.
[0033] as 0.5mm with the larger gap of the development sleeve 141 and the image support 10 in a development region than thickness (developer) -- during this period -- AC bar of 2kV and 8KHZ -- a chair and the DC bias of -750V are overlapped and are impressed. The development sleeve 141 is rotated normally to the image support 10, since electrification of VDC, VH, and a toner is like-pole nature, the toner which was able to give the cause to secede from a carrier does not adhere to the portion of VH with potential higher than VDC, but adheres to VL portion with potential lower than VDC, and development (reversal development) is performed by VAC.
[0034] In addition, it is also possible to enable it to check a residue by looking easily by fabricating a toner bottle with a translucent material at the same time it carries out small simplification of the feeder of a toner by using the toner bottle with which the aforementioned toner box is loaded as a toner hopper as it is, although not illustrated.
[0035] Imprint material (not shown) is stored on single-sided criteria in the sheet paper cassette 15, therefore it sells, and a pawl 151 is inclined and located in the datum-level side of imprint material, being prepared only in the datum-level side of imprint material, and a roller 16 also being further used as a cantilever structure for a half moon.

[0036] The feed section has the motor (not shown) of dedication, deals with the imprint material which the roller 16 rotated and pushed up in the **** direction for a half moon, and was loaded on the board 152, and takes out only one sheet of the maximum upper layer according to an operation of a pawl 151.
[0037] After the imprint material taken out from the sheet paper cassette 15 suspends a motor by detection of the feed sensor which is not illustrated just after close makes a U-turn to a conveyance system way and a head passes the feed roller 17, a motor begins a revolution again in the phase in which the timing of an imprint was ready, and it maintains a predetermined angle to the sensitization stratification plane of the image support 10, and is fed to the imprint region.
[0038] On the other hand, feeding by manual bypass is performed by rotating and setting to the location shown as a continuous line from the location which shows the manual paper feed base M located in the front face of the main part of equipment with the alternate long and short dash line of drawing 1 .
[0039] The paper by which manual bypass was carried out is conveyed by revolution of a pickup roller 153, and is fed to an imprint region through the same process as feeding from the sheet paper cassette 15 mentioned above.
[0040] The papers made into the object of a manual paper feed are the cardboard of 36lbs besides the general imprint material P of 16lbs(es) usually used thru/or 24lbs(es), the transparency for OHP, etc. Moreover, feeding of an envelope is also possible by removing the manual paper feed base M and equipping with the feeder of dedication as an option.
[0041] Although the location to the peripheral surface of the image support 10 is adjustable and is always put on a pressure-welding condition at the time of the print of a monochrome image, the imprint roller 18 is maintained at the location which evacuated during formation of a color picture and was estranged, and a pressure welding is carried out only at the time of an imprint. On the other hand, the separation brush 19 also carries out actuation of a pressure welding and alienation to the peripheral surface of the image support 10 almost synchronizing with location fluctuation of the imprint roller 18. By +3 thru/or 4KVDC(s), the imprint roller 18 of the format which cleans a roller side with a blade is used, and it is used for this imprint roller 18 for the bias voltage which superimposed DC and AC to the separation brush 19 by applied voltage, impressing.
[0042] An anchorage device 20 is the so-called anchorage device of the heat mechanical control by roller which consists of the roller of a couple, carries out heating conveyance of the imprint material P by the nip section which carried out the pressure welding to the upper roller 201 and this upper roller 201 which contain Heater H and carry out an actuation revolution clockwise, and was formed between the lower rollers 202 which carry out a follower revolution, and performs joining of a toner image. Siwa of the space which is easy to produce in case an envelope etc. is conveyed is prevented by each up-and-down roller's of both having the heat-resistant tube covered, and forming the nip section in the shape of a straight line by the pressure welding. Clearance cleaning of the dirt which the peripheral surface temperature of an upper roller 201 was controlled when detected by temperature sensor S, and it was maintained in the predetermined temperature requirement, and adhered by joining of a toner is carried out by the pressure welding of a cleaning roller 203. This cleaning roller 203 is exchanged for a new thing by about 40,000 print number of sheets. Moreover, if the time amount which is not used exceeds predetermined time, it will become SLEEP mode and energy-saving control of the fixing heater will be carried out.
[0043] When using the transparency furthermore used for OHP as imprint material, a silicone oil is applied to a roller front face with the oil pad 204 of the peripheral surface of an upper roller 201 from the object which graduates the toner image surface and prevents scattered reflection in order to improve the permeability of the toner image of a color.
[0044] Therefore, by making the bearer rate of imprint material switchable at the three-stage of 100 mm/sec, 50 mm/sec, and 12.5 mm/sec, the equipment of this example is equipped with the mode which can use a regular paper, an envelope, and three sorts of imprint material of transparency, and is used corresponding to a broad use.
[0045] In addition, the laying temperature of an upper roller 201 can form low temperature about 180-degree-C order by using the toner fused at low temperature, and by using sponge material (porosity PTFE coat) for the oil pad 204, press nonuniformity is canceled and uniform oil spreading is realized.
[0046] The above is the outline configuration of the image formation equipment in this example.

[0047] Next, the control circuit of image formation equipment is explained.
[0048] Drawing 2 is the block diagram showing the control circuit in the image formation equipment of this example, and drawing 3 is the perspective diagram showing the arrangement condition of the image concentration sensor C.
[0049] As shown in drawing 2 , a control circuit 200 A microprocessor 210 (below, it is called MPU for short) and A/D converter 250, The program for electrification control RAM220 and PWM control which were written in RAM240 which wrote in the program module for performing the electrostatic photograph process of RAM230 and others which wrote in the program module to perform, and RAM which wrote in the program which constitutes a development nature fixed means (not shown), It has RAM which wrote in the program which constitutes a printer property detection means and the highest image concentration conversion means. MPU210 is connected to the solenoid for driving a churning screw through the driver (not shown).
[0050] A printer property detection means is constituted from RAM230 which wrote in the image concentration sensors C and MPU210 and the test patch signal SG, and detects the highest image concentration from a actual printer property and it. The program concerned also includes the program equivalent to the highest image concentration conversion means.
[0051] The program equivalent to an image concentration detection means By carrying out A/D conversion of the luminance signal It is what acquires an image concentration signal in consideration of the difference with the concentration of the image support 10, and the concentration of a transfer paper to the value which carried out logarithmic transformation of the ratio with the rated maximum output (output in the condition that nothing adheres on image support) of the image concentration sensor C to the output voltage normalized to 256 gradation. The value which performed and averaged predetermined processing to the luminance signal acquired from two or more patch images which developed on the image support 10 in order to remove the detection error resulting from the oscillation produced during the revolution of the image support 10 is computed (refer to JP,1-41375,A). By this, MPU210 can detect the printer property and the maximum image concentration which removed the detection error resulting from the oscillation of the image support 10.
[0052] MPU210 be a toner concentration control system which control toner concentration by change of permeability uniformly regardless of development nature, and since it be influence by change of the sensitivity property of a sensitization layer like a means to detect the amount of development of image support optically, it collateralize the development nature in the reversal development method uniformly by carry out adjustable [of the rotational frequency of the development sleeve 141].
[0053] A toner concentration control means detects the permeability of the developer with which it loaded into development counter 14A - 14D by the toner concentration sensor TS, and when this drives a toner makeup unit (not shown), it controls toner concentration to abbreviation regularity.
[0054] The program which constitutes a development nature fixed means by controlling the rotational frequency of the development sleeve 141 according to the patch toner image 1 which developed on the image support 10 By obtaining the development nature beyond the sensitization property of a sensitization layer, and controlling uniformly the toner concentration which is closely related to development nature The amount of the developer which controls the rotational frequency of the development sleeve 141 and adheres in the development field of image support 10 front face is changed, and the maximum image concentration is adjusted. The program which constitutes a development nature fixed means contains the device and control program which control the toner concentration in a developer tank uniformly, when adopting a two component developer. A/D converter 250 has connected the image concentration sensor C through amplifier 251. Amplifier 251 amplifies the output level from the image concentration sensor C on the driver voltage level of a microprocessor 210.
[0055] The image concentration sensor C forms in Casing CK a slot which makes the angle whose centers of the light-receiving side of the light emitting diode LED (light emitting diode LN66, the Kagoshima Matsushita electronic incorporated company make) and the photo transistor PT (the photo transistor PN 101, the Kagoshima Matsushita electronic incorporated company make) which emit light in infrared light are 40 degrees and 40 degrees, as shown in drawing 3 , and it inserts it in light emitting diode PD and a photo transistor PT in the slot concerned. The whole surface of Casing CK is prepared from image support 10 front face in the 6mm gap so that it may become level on the front face of the image support 10 and the center of the image support 10 may be countered near the cleaning unit 22. The image concentration sensor C constitutes phot coupling from light emitting diode LED and a photo transistor PT. Adjustable DC power supply Vref (not shown) of the maximum output 10 (V) are connected to the anode terminal of light emitting diode LED, and the semipermanent resistance element VR 1 (not shown) and the fixed-resistance element R8 (not shown) which can be switched to 1k (omega) and 2k (omega) are connected to the cathode terminal of light emitting diode LED. By making it such a configuration, adjustable [of the output voltage of adjustable DC power supply Vref] is carried out, and the luminescence reinforcement of light emitting diode LED is adjusted. DC power supply VDC of 10V are connected to the anode terminal of a photo transistor PT, and the output detector which consists of an operational amplifier IC (not shown) and fixed-resistance elements R5 and R6 (not shown) is established in the cathode terminal. Such a configuration detects the voltage according to the optical reinforcement which received light by phot galvanized iron JISUTA PT. It enables it to have received by this the light reflected from a toner image efficiently.
[0056] In addition, the decision method of the luminescence quantity of light of light emitting diode LED which constitutes the image concentration sensor C determines that it is set to V0 by the output voltage from the photo transistor PT which received the light which emits light and reflects light emitting diode LED from the image support 10 (condition that a toner has not adhered). The dirt of the protection-against-dust glass (not shown) which

constitutes the image concentration sensor C by this, and image support 10 front face can be amended.
[0057] It is the mechanical configuration and electric configuration in image formation equipment of the above this example.
[0058] Here, the patch image adopted by this example is explained.
[0059] Drawing 4 is the mimetic diagram which expanded the patch image formed on image support.
[0060] A patch image is preceded with original image formation, and forms two or more patch images (refer to drawing 4) constituted with the toner image of line breadth with which each differed on the image support 10.
[0061] In drawing 4 , the arrow head shows the hand of cut of the image support 10, and the slash shows that the toner has adhered. The condition of drawing 4 (a) having shown five patch images, having fixed line breadth of the line which forms a patch image by 50 micrometers, and carrying out sequential change of the gap of 50 micrometers of a line, 75 micrometers, 100 micrometers, 125 micrometers, and the 150 micrometers is shown. Drawing 4 (b) shows five patch images, and the condition of having changed the line breadth of the line which forms a patch image so that it might become thin one by one with 100%, 80%, 60%, 40%, and 20% is shown. Actuation fundamental also in the monochrome of specification [the toner line image which forms the patch image concerned also in which patch image], or the secondary color which piled up two colors is the same. As for the thinnest thing of line breadth, in the toner line image which constitutes a patch image, it is desirable to set it as the size which does not overlap the toner image which adjoined each other even if it took all fluctuation expected into consideration. Even if the thickest thing of line breadth takes all fluctuation expected into consideration, it is desirable to set it as the size which overlaps the toner image which always adjoined each other. Moreover, as for the magnitude of a patch image, it is desirable to make it larger than the measuring range of a sensor in order to secure sensitivity.
[0062] Each of drawing 6 and drawing 7 is graphs which show the relation between reflection density and line spacing.
[0063] The graph shown in drawing 6 and drawing 7 shows the relation of the reflection density and pulse width which are obtained from the patch image shown in drawing 4 (a). The graph shown in drawing 7 shows the case where concentration is highly measured with dirt. In any case, it turns out that point of inflection b exists. Since the regular reflection from the patch image shown in drawing 4 (a) is larger than the echo from a toner 10 or more times, in the process in which a toner image covers the front face of the image support 10, and goes like the field 1 of drawing 6 , its change is large. After a toner image covers all image support 10 front faces, it is shown that the change by the layer of a toner increasing turns into a loose change at the business of the field 2 of drawing 6 .
[0064] Each of drawing 8 and drawing 9 is graphs which show the relation between reflection density and pulse width.
[0065] The graph shown in drawing 8 and drawing 9 shows the relation of the reflection density and pulse width which are obtained from the patch image shown in drawing 4 (b). The graph shown in drawing 9 shows the case where there is sensitivity change of the image support by the environmental variation or secular change, from the graph shown in drawing 8 . In any case, it turns out that point of inflection a exists. Since the regular reflection from the patch image shown in drawing 4 (b) is larger than the echo from a toner 10 or more times, in the process in which a toner image covers the front face of the image support 10, and goes like the field 1 of drawing 8 , its change is large. After a toner image covers all image support 10 front faces, it is shown that the change by the layer of a toner increasing turns into a loose change at the business of the field 2 of drawing 8 .
[0066] Next, the line breadth control method in the image formation equipment of this example is explained.
[0067] Image formation equipment explains setting-out processing of the rotational frequency of the development sleeve 141 for obtaining the desired highest image concentration (1.4).
[0068] An operator sends out a copy initiation command to MPU210 from a control panel (not shown). MPU210 detects the phase of the image support 10 with the phasing signal outputted from an encoder (not shown), and rotates the image support 10 in the **** direction (reference, such as drawing 1) from the phase. MPU210 impresses predetermined output voltage to the electrification machine 12 from a high voltage power supply (not shown), and thereby, the electrification machine 12 starts discharge and is uniformly charged in the image formation field of the image support 10. Then, the output voltage of the source Vref of direct-current good transformation is set up so that it may be set to 7 (V) with the sensor output in the portion which changes the output voltage of adjustable DC power supply Vref to light emitting diode LED (refer to drawing 4) which constitutes the image concentration sensor C, and does not have a toner patch. It is made to oscillate with this applied voltage, and infrared light is irradiated at the image support 10. A patch image is formed on the image support 10. The exposure level at the time of creating a patch image at this time uses PWM255 which is the maximum light exposure. Thus, the created latent image is developed with the development sleeve 141 of a different rotational frequency. The rotational frequency of the development sleeve 141 is raised to 450rpm every 25rpm from 100rpm. And two or more patch images then created are read by the image concentration sensor C. It means that the rotational frequency of the development sleeve 141 is fixed when the output value read to sensor output 1.5V which are equivalent to 1.4 by fixation image concentration (Macbeth image concentration meter activity) becomes coincidence or an output not more than it, and the printer had secured 1.4 or more by the maximum image concentration. In addition, although based also on the properties (the amount of charges, toner concentration, fluidity, etc.) of a developer, and the surface potential property of a sensitization layer, the rotational frequency of the development sleeve 141 is fixed to about 225 rpm (the ratio of development sleeve lead ** / image support linear velocity is about 1.60) in ordinary temperature normal relative humidity (an equivalent for 20-degree-C50%RH).
[0069] MPU210 performs line breadth measurement processing which showed the width of face of a linear toner

image in drawing 4 (b) in which it asks for line breadth indirectly from the reflection density of a patch image, following decision actuation of the rotational frequency of the development sleeve 141 mentioned above.
[0070] Specifically, MPU210 is sent out to the Pulse-Density-Modulation circuit (not shown) which constitutes write-in equipment 13 for a patch signal from RAM230 which constitutes an PWM control means. A Pulse-Density-Modulation circuit (not shown)'sends out the modulating signal which carried out Pulse Density Modulation of the patch signal for 1 scan line to LD actuation circuit (not shown). LD actuation circuit — a modulating signal — semiconductor laser — oscillation **** — a laser beam is irradiated by things. It is made to deviate by the polygon mirror which rotates this laser beam at predetermined speed, and by ftheta lens, the 1st cylindrical lens, and the 2nd cylindrical lens, on the image support 10, it extracts to a minute spot and scans. The above latent-image formation actuation is repeated the number of predetermined times. MPU210 drives development counters 14A-14D in the location which synchronized with the electrostatic latent image, after detecting the phase of the image support 10 from the phasing signal sent out from an encoder (not shown), if termination of latent-image formation actuation is detected. Thereby, the latent image currently formed on the image support 10 develops two or more patch images shown in drawing 4 .
[0071] MPU210 detects the phase of the image support 10 from the phasing signal from an encoder, and it sets up the output voltage of the source Vref of direct-current good transformation so that the sensor output in the portion which changes the output voltage of adjustable DC power supply Vref to light emitting diode LED (refer to drawing 3) which constitutes the image concentration sensor C, and does not have a toner patch may be set to 7 (V). It is made to oscillate with this applied voltage, and infrared light is irradiated at the image support 10. Thereby, the photo transistor PT which constitutes the image concentration sensor C sends out the sensor output according to the optical reinforcement reflected from the patch image which developed on the image support 10 to MPU210 through A/D converter 251.
[0072] If the sensor output obtained from the patch image which developed 5.8 (V) Becomes, since the maximum output of a sensor will be 7V, MPU210 is image concentration. - Data is made up for and it is interpolating because 32 data of PWM 0-248 interpolates an operation like log5.8 (V)/7 (V). The method of the interpolation concerned may adopt the method of common knowledge, such as a straight-line spline and the Lagrange straight line, or a interpolation method original with a layout top. Here, interpolation by the cubic spline function was performed (Kyoiku Shuppan: refer to a spline function and its application).
[0073] Since it fixed to 1.4 at the rotational frequency of the development sleeve 141, the maximum image concentration is the concentration operation value of the sensor output of the PWM level 255. - log (the sensor output of PWM255 level / 7 (V)) also needs to be 1.4. Since the sensor output of PWM255 of the sensor output on [PWM / 248] a property of image formation equipment is also almost the same, -log (the sensor output of PWM248 level / 7 (V)) also needs to be 1.4. Then, a printer property is acquired by normalizing the operation value of the obtained concentration by 1.4 of the maximum image concentration. However, since the image concentration on a transfer paper with the actual concentration of PWM0 has the concentration of a transfer paper, = (fixation image concentration got by the concentration meter) (concentration of the patch toner image on the image support obtained from a sensor output) is obtained by applying the concentration of a transfer paper to the acquired concentration operation value. In addition, you may make it MPU210 raise detection precision by reading two or more times to a patch image, and averaging the value.
[0074] Even if it changes and prints line width of face, it is necessary to determine the line width of face which has neither alphabetic character crushing nor alphabetic character **** by viewing, and generally in Japan using the kanji with many stroke counts, it is about 120 micrometers. Image formation equipments, such as a printer, are adjusted by electrification potential and the width of face of PWM so that it may become 120 micrometers by the standard operating environment in a shipment phase. However, the image reproduced to imprint material produces change to concentration and line width of face by aging of the image support 10 or a developer, and environmental change. Therefore, it is necessary to adjust electrification potential and PWM and to reset to initial value by measuring concentration and line width of face before a power up or printing initiation.
[0075] In the image formation equipment of this example, in order to consider as a good quality of printed character, MPU210 measures printing concentration, resets and sets a line pitch to 120 micrometers of initial value to initial value continuously, carries out sequential change of the PWM value, and it asks for point of inflection. That is, MPU210 asks for the intersection of the tangent of a parabola shown in drawing 8 as point of inflection a. The line breadth and the pitch of a toner image recognize as an equal the point of inflection a which calculated MPU210 as mentioned above. MPU210 calculates ** with the pulse width used for the patch image formation for obtaining the image concentration obtained as mentioned above. MPU210 computes the optimal pulse width from said point of inflection a.
[0076] Here, it depends for the calculation precision of point of inflection a only on the index signal for controlling the timing of the write-in means 13 of operation. Since the quartz resonator of high degree of accuracy etc. is used in order that the line breadth detection method in this example may acquire a reference signal, the calculation precision of point of inflection a is also maintained at high degree of accuracy. Therefore, since the line breadth measuring method of this example did not measure directly the absolute value or line breadth of reflection density which require high degree of accuracy of the image concentration sensor C but line breadth is detected using the signal of high degree of accuracy like an index signal, even if the line breadth control method in this example is the image concentration sensor C which does not require a high precision, it can detect line breadth using the signal of high degree of accuracy. Moreover, since the mounting precision of the image concentration sensor C of the line

breadth control method in this example may also be rough, the adjustment routing counter of the image concentration sensor C can also be decreased. Moreover, according to the line breadth control method in this example, it is not influenced by the sensitivity lowering by the environmental variation or aging of the image concentration sensor C.

[0077] In addition, although it explained controlling MPU210 to adjust the pulse width signal for forming a latent image by making into initial value the PWM value recognized by the above-mentioned processing, it is not limited to this and you may make it adjust to the grid voltage of the electrification machine 12, the rotational frequency of development counters 14A-14D, and one process conditions of the development bias in this example. Moreover, control action is the same as the above-mentioned explanation about the patch image shown in drawing 4 (a).

[0078]

[Effect of the Invention] The line breadth control method which controls the toner line image which invention of claim 1, claim 3, and four publications detects the line breadth of a toner line image by several micrometers to about 10 micrometers by having the above-mentioned configuration, and is reproduced to predetermined line breadth will be offered. Moreover, since invention of claim 1, claim 3, and four publications has detected line breadth using the signal of high degree of accuracy like an index signal, even if it is an image concentration sensor which is not highly precise, it can detect line breadth using the signal of high degree of accuracy. Moreover, since the mounting precision of the image concentration sensor C of invention of claim 1, claim 3, and four publications may also be rough, the adjustment routing counter of a concentration sensor can also be decreased and it is not influenced by the sensitivity lowering by the environmental variation or aging of a concentration sensor.

[0079] When invention according to claim 2 to 4 is equipped with the above-mentioned configuration, the line breadth control method applicable also to the image formation equipment which adopts a color picture formation process in addition to said effect will be offered.

[0080] When invention according to claim 5 is equipped with the above-mentioned configuration, the line breadth control method which can make sensitivity of a sensor high in addition to the aforementioned effect will be offered.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the line breadth control method of adjusting the line breadth of the line line image reproduced in an electrophotography process to predetermined width of face.

[Translation done.]

PRIOR ART

[Description of the Prior Art] In the image formation equipment which adopts an electrophotography process, the reproduced line image changes the concentration and line breadth of an image with the temperature of image environment, humidity, image support, the use counts of a developer, etc. In the image formation equipment which forms a toner image by reversal development on image support, the phenomenon of changing the width of face of a linear toner image is explained with reference to drawing 12 .

[0003] Drawing 12 is a mimetic diagram explaining the phenomenon of changing the width of face of a linear toner image. Drawing 12 (a) VZ which - (e) takes potential along an axis of ordinate, and length is shown on a horizontal axis, shows the concentration and line breadth of a toner image typically by this, and is shown according to a two-dot chain line shows rest potential. Drawing 12 (a) is the mimetic diagram showing the latent image which carried out image exposure and formed image support after being charged. Drawing 12 (b) shows the portion equivalent to toner coating weight, when the latent image shown in drawing 12 (a) is developed, and the dotted line shows the surface potential of a toner. Drawing 12 (c) is the mimetic diagram showing the latent-image potential at the time of going up from the initial state which rest potential Vz showed to drawing 12 (a) by repeat activity. The alternate long and short dash line in drawing 12 (d) shows the portion equivalent to the toner coating weight when developing the latent image shown in drawing 12 (c). Although it is hardly different from the line breadth of the toner image shown in this field sign 12 (b), it is shown that image concentration falls. Although what controlled and developed development conditions shows by the dotted line and shows that image concentration can be made the same in order to amend lowering of this image concentration, it is shown that line breadth increases. Although there is no change in the maximum image concentration when drawing 12 (e) shows the condition with the loose gamma characteristics of the sensitization layer of image support of having carried out direction change and develops it under these conditions, it is shown that line breadth becomes narrow.

[0004] In order to suppress change of the image concentration and line breadth which were mentioned above, an environmental temperature and humidity are measured, and when temperature is high, detecting and feeding back the line breadth and image concentration of a toner image etc. is performed by measuring amendment of setting up electrification potential more highly, and the reflection density of a toner patch. For this line breadth measurement means, a direct measurement method and an indirect-measurement method can be considered.

[0005] Drawing 10 is the block diagram showing a line breadth measurement means to measure the line breadth of a toner image directly.

[0006] The line breadth measurement means of this direct measurement method can consider detecting the line breadth of a toner image by having the image formation lens L2 which expands and carries out image formation of the light which reflects the light from the light source P from the image formation lens L1 which carries out image formation to the image support Z, and the toner image TG which supported to the image support Z to a photo detector LS, and counting the output signal from a photo detector LS.

[0007] Drawing 11 is the block diagram showing a line breadth measurement means to measure the line breadth of a toner image indirectly.

[0008] The line-breadth measurement means of this indirect-measurement method is equipped with the image-formation lens L3 which reduces and carries out image formation of the light which reflects the light from the light source P from the image-formation lens L1 which carries out image formation to the image support Z, and the toner image TG which supported to the image support Z to a photo detector PD, regards the front face of image support as change of wrap coverage, and detects it as change of the amount of reflected lights by the photo detector PD which has a single light sensing portion. Since the photo detector PD adopted here has a single light sensing portion and it is sufficient for it, it becomes cheaper than a line breadth measurement means to measure direct radiation width of face as shown in drawing 10 .

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] The line breadth control method which controls the toner line image which invention of claim 1, claim 3, and four publications detects the line breadth of a toner line image by several micrometers to about 10 micrometers by having the above-mentioned configuration, and is reproduced to predetermined line breadth will be offered. Moreover, since invention of claim 1, claim 3, and four publications has detected line breadth using the signal of high degree of accuracy like an index signal, even if it is an image concentration sensor which is not highly precise, it can detect line breadth using the signal of high degree of accuracy. Moreover, since the mounting precision of the image concentration sensor C of invention of claim 1, claim 3, and four publications may also be rough, the adjustment routing counter of a concentration sensor can also be decreased and it is not influenced by the sensitivity lowering by the environmental variation or aging of a concentration sensor.
[0079] When invention according to claim 2 to 4 is equipped with the above-mentioned configuration, the line breadth control method applicable also to the image formation equipment which adopts a color picture formation process in addition to said effect will be offered.
[0080] When invention according to claim 5 is equipped with the above-mentioned configuration, the line breadth control method which can make sensitivity of a sensor high in addition to the aforementioned effect will be offered.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in spite of having fed back by amendment of the above-mentioned electrification potential, or measurement of the reflection density of a toner patch, since change of line breadth was as small as several micrometers to about 10 micrometers, there was nothing that can be measured directly with cheap equipment. Since a line breadth measurement means as shown in drawing 10 will specifically need the line sensor formed in the pitch of about severalmicro per pixel in order to detect fluctuation of line breadth with a sufficient precision, and the scale factor of the optical system which consists of a photo detector L2 will need an about 10-time scale factor, it becomes cost high. If the focal distance of the above-mentioned optical system is set to 5mm, since the whole sensor serves as magnitude of 50mm or more, it becomes the magnitude which is hard to include in the image formation equipment in the inclination to miniaturize. On the other hand, since the line breadth measurement means explained with reference to drawing 11 will grasp the toner image as a gestalt for which two or more linear toner images gathered, it cannot distinguish and measure change of line breadth, and change of image concentration. Therefore, even if it adjusted development conditions etc. and has maintained image concentration to predetermined, since the output level from a photo detector PD was related to the line breadth of a toner image, an output will also change with an environmental variation, aging, dirt, etc., and it was not able to amend the error. Moreover, since an absolute precision of a sensor was required of any method, it did not have what can be used being able to incorporate in image formation equipment. Moreover, the circuit for driving a line sensor and the circuit which reads the output signal from a line sensor also become intricately and expensive.
[0010] The object of this invention is to offer the line breadth control method which controls the toner line image which detects the line breadth of a toner line image by several micrometers to about 10 micrometers, and is reproduced to predetermined line breadth in view of the above-mentioned trouble.

[Translation done.]

MEANS

[Means for Solving the Problem] There are the following as a means to attain the above-mentioned object.
[0012] (1) A pulse width control process of adjusting a pulse width signal which controls luminescence of the light source, A patch latent-image formation process which forms a patch latent image which consists of two or more line latent images by irradiating light from said light source, A **** process which develops said patch latent image in a patch image which consists of a toner line image, A process which forms two or more patch images with which a **** process is repeated from said pulse width control process, and gradation differs, and a process which measures optical density of said patch image, A line breadth control method which consists of a point-of-inflection detection process of detecting point of inflection in ** of reflection density using an index signal from said toner line image and patch image, and a process condition adjustment process of adjusting conditions of an electrophotography process from data in said point of inflection.
[0013] (2) Said patch image is the line breadth control method of of (1) characterized by piling up two or more colors.
[0014] (3) Said patch image is either line breadth control method of (1) and (2) characterized by changing a gap, seting line breadth of a toner line image as constant.
[0015] (4) Said patch image is either line breadth control method of (1) and (2) characterized by changing line breadth of a toner line image.
[0016] (5) Magnitude of said patch image is either line breadth control method of (1) and (2) characterized by making it larger than measuring range of a sensor, and having carried out.

[Translation done.]

EXAMPLE

[Example] Drawing 1 is the outline block diagram showing the image formation equipment of this example, and drawing 5 is a graph which shows the potential property of the image support adopted as the image formation equipment of this example.
[0018] For every revolution of the image support 10, it is based on the electrification machine 12 and the image formation equipment of this example is charged, as shown in drawing 1 . The electrostatic latent image whose color was separated on the image support 10 by image exposure by write-in equipment 13 is formed. To the periphery of the image support 10 in order are full color and to reproduce the electrostatic latent image concerned Yellow, Make it operate selectively from the development counters 14A-14D which contained the two component developer which consists of a Magenta, cyanogen, and a black toner and a black carrier, respectively, and it develops in a toner image. By repeating a series of processes which form the toner image concerned in the image support 10 two or more times for every color, after bundling up with the imprint roller 18 to the imprint material sent from a sheet paper cassette 15 after piling up each color toner image on the image support 1 and imprinting to it, it is established with an anchorage device 20.
[0019] The main part housing of image formation equipment is formed from the upright side panel 1 (not shown) and the upright side panel 2 (not shown). The development unit 120 which stores two or more development counters 14A-14D with write-in equipment 13 and the image support 10 among side panels 1 and 2, Furthermore, an anchorage device 20 and a DC power supply unit (not shown) are incorporated. On the other hand, the control board (not shown) for operating-sequence control of a drive system, the formatter (not shown) which decodes a printer command, and a machine is stored in the outside of a side panel 2. Moreover, a toner makeup means 140 to connect with each development counters 14A-14D in the development unit 120 is held in the upper part of the development unit 120.
[0020] The image support 10, the electrification machine 12, and cleaning equipment 22 are incorporated and united with the drum cartridge 130 (not shown), and, on the other hand, each development counters 14A-14D and a toner makeup means (not shown) are incorporated and united with the stand 100 (not shown). A stand 100 is positioned in the location which can perform image formation actuation, or is equipped with the configuration for moving almost horizontally and setting it as the drawer location from the stowed position to the main part of equipment, as shown in drawing 1 .
[0021] The guide idler 53 (not shown) is provided so that each inner surface of a side panel 1 and a side panel 2 which forms the main part of equipment may be faced at a upper rail 51 (graphic display ****) and the lower rail 52 (not shown), and on the other hand, it has the plate-like part material 41 which equips the side of the right and left with the rotation roller 42, and the rotation roller 42 is engaged with the guide member 50, and a stand 100 engages plate-like part material 41 the very thing with a guide idler 53, respectively, and supports It is an outline configuration for attaining the function which this mentioned above.
[0022] Below, it is attached to the configuration and function of each part material, and explains.
[0023] The image support 10 on the conductive base material of phi 120 fabricated from the aluminum For example, coating of the under-coating layer of 0.3 micrometers of thickness is carried out with alcoholic fusibility polyimide. Apply the CGL agent which distributed the polyvinyl butyral for Y mold CHITARU phthalocyanine on the under-coating layer concerned, and coating of the CGL of 0.3 micrometers of thickness is carried out. It is the electrophotography photo conductor which carried out coating of the CTL of 25 micrometers of thickness which consists of a polycarbonate and a still triphenylamine system compound, and carried out the laminating of an interlayer and the sensitization layer on the CGL concerned, and has grounded. The encoder (not shown) is formed in the driving shaft 103 of the image support 10, and thereby, MPU210 detects the phase of the image support 10, and has been made to perform the electrophotography process.
[0024] Here, the potential property of the image support 10 is explained with reference to drawing 5 .
[0025] The surface potential (- V) of the image support 10 is shown on the axis of ordinate by the graph shown in drawing 5 , and the power (mW) of semiconductor laser is shown on the horizontal axis. O The potential property in 20-degree-C50%RH (this may be hereafter called ordinary temperature normal relative humidity NN) is shown, ** shows the potential property in 30-degree-C80%RH (this may be hereafter called high-humidity/temperature HH), and ** shows the potential property in 10-degree-C20%RH (it may be called low-humidity/temperature LL). This graph shows changing the surface potential in the exposure field of the image support 10 with environmental temperature humidity. Here, an exposure field means fields other than initial electrification potential.
[0026] The driving shaft 103 and the revolution of both the flanges 101,102 (not shown) that support image support

10 peripheral surface are enabled, and they form the spring member 105 between the holddown member 104 (not shown) fixed to the driving shaft 103, and one flange 101, and have connected each other with it. When it does in this way, an effect equivalent to having made low rigidity of a drive system which consists of image support 10 and a driving shaft 103 is acquired, a resonant frequency is lowered, and it can avoid resonating with fluctuation of the oscillation from a driver G. And fluctuation of the rotational speed inputted into the driving shaft 103 can be made to be able to absorb by the low rigidity member, and the image support 10 can be rotated, without producing fluctuation of 100 mm/sec linear velocity.
[0027] in order to abolish the hysteresis of the photo conductor to a front print in advance of negative electrification in which the image support 10 was stabilized according [PCL11] to the electrification machine 12 since revolution actuation is carried out by realizing the driving force transfer method with this configuration -- light emitting diode etc. — using — exposure — carrying out — the sensitization layer peripheral surface of the image support 10 — discharging electricity . The electrification machine 12 gives uniform electrification of VH-850V by carrying out corona discharge to VG to the peripheral surface of the image support 10 from the corona discharge wire which consists of a grid by which potential maintenance was carried out, and a platinum wire (a clad or alloy).
[0028] Through the polygon mirror 131 and ftheta lens 133 grade which make the laser diode which is not illustrated based on a picture signal after being uniform charged to the sensitization layer of the image support 10 the luminescence light source, and rotate, write-in equipment 13 bends an optical path by the reflective mirror 132, scans, and forms a latent image by the revolution (vertical scanning) of the image support 10. That is, if the image data from a formatter is sent to a laser diode (LD) modulation circuit and a laser diode emits light with the modulated picture signal, the synchronization of each scanning line will be achieved by the beam index 136 (not shown) through a mirror 137 (not shown), and it will be projected on the beam light by the polygon mirror 131. The polygon mirror 131 reflects and scans beam light with the polyhedron, after, as for the scan light, a beam shape is amended by the ftheta lens 133 and the cylindrical lens 134, it exposes a photo conductor through the reflective mirror 132, performs horizontal scanning, and forms an electrostatic image. the polygon mirror 131 — a 6th page mirror — pneumatic bearing adoption of rotational frequency 23600rpm — it carries out. The focal distance of the ftheta lens 133 and cylindrical-lens 134 grade is f= 140mm. Dot clocks are 20MHZ(s). A beam diameter is about 140x100 micrometers. It is latent-image potential VL-50V of this beam diameter.
[0029] In order to obtain a high quality picture, it is necessary to also make particle size of a toner small. In this example, each color is using the toner with a size of 8 micrometers. However, for a user, black alphabetic character quality is the most important and the diameter toner of a granule (7 micrometers - 11 micrometers) is suitable for a black toner. thereby, the print density of image formation equipment also boils ******, it is 12 dot(s)/mm and the dot pitch may be 1/12mm.
[0030] The toner supplied from the toner box (not shown) falls at the right edge of a development counter, and churning mixing is carried out by the churning screw of the couple which rotates in the opposite direction with a carrier, and it is set as the predetermined amount (Q/M) of electrifications by it.
[0031] On the other hand, toner concentration is detected by L ******, controls the amount of supply of a toner based on this output frequency, and setting-out control is carried out at 5 thru/or about 7% of toner concentration value.
[0032] The agitated two component developer is conveyed by the development sleeve 141 through a feed roller 143, it is made a thin layer by thickness specification-part material (not shown), is conveyed two times 20 to 30 mg/cm in the development region of the image support 10, and performs reversal development of an electrostatic latent image according to the development conditions described below.
[0033] as 0.5mm with the larger gap of the development sleeve 141 and the image support 10 in a development region than thickness (developer) — during this period — AC bar of 2kV and 8KHZ — a chair and the DC bias of -750V are overlapped and are impressed. The development sleeve 141 is rotated normally to the image support 10, since electrification of VDC, VH, and a toner is like-pole nature, the toner which was able to give the cause to secede from a carrier does not adhere to the portion of VH with potential higher than VDC, but adheres to VL portion with potential lower than VDC, and development (reversal development) is performed by VAC.
[0034] In addition, it is also possible to enable it to check a residue by looking easily by fabricating a toner bottle with a translucent material at the same time it carries out small simplification of the feeder of a toner by using the toner bottle with which the aforementioned toner box is loaded as a toner hopper as it is, although not illustrated.
[0035] Imprint material (not shown) is stored on single-sided criteria in the sheet paper cassette 15, therefore it sells, and a pawl 151 is inclined and located in the datum-level side of imprint material, being prepared only in the datum-level side of imprint material, and a roller 16 also being further used as a cantilever structure for a half moon.

[0036] The feed section has the motor (not shown) of dedication, deals with the imprint material which the roller 16 rotated and pushed up in the **** direction for a half moon, and was loaded on the board 152, and takes out only one sheet of the maximum upper layer according to an operation of a pawl 151.
[0037] After the imprint material taken out from the sheet paper cassette 15 suspends a motor by detection of the feed sensor which is not illustrated just after close makes a U-turn to a conveyance system way and a head passes the feed roller 17, a motor begins a revolution again in the phase in which the timing of an imprint was ready, and it maintains a predetermined angle to the sensitization stratification plane of the image support 10, and is fed to the imprint region.
[0038] On the other hand, feeding by manual bypass is performed by rotating and setting to the location shown as a

continuous line from the location which shows the manual paper feed base M located in the front face of the main part of equipment with the alternate long and short dash line of drawing 1 .
[0039] The paper by which manual bypass was carried out is conveyed by revolution of a pickup roller 153, and is fed to an imprint region through the same process as feeding from the sheet paper cassette 15 mentioned above.
[0040] The papers made into the object of a manual paper feed are the cardboard of 36lbs besides the general imprint material P of 16lbs(es) usually used thru/or 24lbs(es), the transparency for OHP, etc. Moreover, feeding of an envelope is also possible by removing the manual paper feed base M and equipping with the feeder of dedication as an option.
[0041] Although the location to the peripheral surface of the image support 10 is adjustable and is always put on a pressure-welding condition at the time of the print of a monochrome image, the imprint roller 18 is maintained at the location which evacuated during formation of a color picture and was estranged, and a pressure welding is carried out only at the time of an imprint. On the other hand, the separation brush 19 also carries out actuation of a pressure welding and alienation to the peripheral surface of the image support 10 almost synchronizing with location fluctuation of the imprint roller 18. By +3 thru/or 4KVDC(s), the imprint roller 18 of the format which cleans a roller side with a blade is used, and it is used for this imprint roller 18 for the bias voltage which superimposed DC and AC to the separation brush 19 by applied voltage, impressing.
[0042] An anchorage device 20 is the so-called anchorage device of the heat mechanical control by roller which consists of the roller of a couple, carries out heating conveyance of the imprint material P by the nip section which carried out the pressure welding to the upper roller 201 and this upper roller 201 which contain Heater H and carry out an actuation revolution clockwise, and was formed between the lower rollers 202 which carry out a follower revolution, and performs joining of a toner image. Siwa of the space which is easy to produce in case an envelope etc. is conveyed is prevented by each up-and-down roller's of both having the heat-resistant tube covered, and forming the nip section in the shape of a straight line by the pressure welding. Clearance cleaning of the dirt which the peripheral surface temperature of an upper roller 201 was controlled when detected by temperature sensor S, and it was maintained in the predetermined temperature requirement, and adhered by joining of a toner is carried out by the pressure welding of a cleaning roller 203. This cleaning roller 203 is exchanged for a new thing by about 40,000 print number of sheets. Moreover, if the time amount which is not used exceeds predetermined time, it will become SLEEP mode and energy-saving control of the fixing heater will be carried out.
[0043] When using the transparency furthermore used for OHP as imprint material, a silicone oil is applied to a roller front face with the oil pad 204 of the peripheral surface of an upper roller 201 from the object which graduates the toner image surface and prevents scattered reflection in order to improve the permeability of the toner image of a color.
[0044] Therefore, by making the bearer rate of imprint material switchable at the three-stage of 100 mm/sec, 50 mm/sec, and 12.5 mm/sec, the equipment of this example is equipped with the mode which can use a regular paper, an envelope, and three sorts of imprint material of transparency, and is used corresponding to a broad use.
[0045] In addition, the laying temperature of an upper roller 201 can form low temperature about 180-degree-C order by using the toner fused at low temperature, and by using sponge material (porosity PTFE coat) for the oil pad 204, press nonuniformity is canceled and uniform oil spreading is realized.
[0046] The above is the outline configuration of the image formation equipment in this example.
[0047] Next, the control circuit of image formation equipment is explained.
[0048] Drawing 2 is the block diagram showing the control circuit in the image formation equipment of this example, and drawing 3 is the perspective diagram showing the arrangement condition of the image concentration sensor C.
[0049] As shown in drawing 2 , a control circuit 200 A microprocessor 210 (below, it is called MPU for short) and A/D converter 250, The program for electrification control RAM220 and PWM control which were written in RAM240 which wrote in the program module for performing the electrostatic photograph process of RAM230 and others which wrote in the program module to perform, and RAM which wrote in the program which constitutes a development nature fixed means (not shown), It has RAM which wrote in the program which constitutes a printer property detection means and the highest image concentration conversion means. MPU210 is connected to the solenoid for driving a churning screw through the driver (not shown).
[0050] A printer property detection means is constituted from RAM230 which wrote in the image concentration sensors C and MPU210 and the test patch signal SG, and detects the highest image concentration from a actual printer property and it. The program concerned also includes the program equivalent to the highest image concentration conversion means.
[0051] The program equivalent to an image concentration detection means By carrying out A/D conversion of the luminance signal It is what acquires an image concentration signal in consideration of the difference with the concentration of the image support 10, and the concentration of a transfer paper to the value which carried out logarithmic transformation of the ratio with the rated maximum output (output in the condition that nothing adheres on image support) of the image concentration sensor C to the output voltage normalized to 256 gradation. The value which performed and averaged predetermined processing to the luminance signal acquired from two or more patch images which developed on the image support 10 in order to remove the detection error resulting from the oscillation produced during the revolution of the image support 10 is computed (refer to JP,1-41375,A). By this, MPU210 can detect the printer property and the maximum image concentration which removed the detection error resulting from the oscillation of the image support 10.
[0052] MPU210 be a toner concentration control system which control toner concentration by change of

permeability uniformly regardless of development nature, and since it be influence by change of the sensitivity property of a sensitization layer like a means to detect the amount of development of image support optically, it collateralize the development nature in the reversal development method uniformly by carry out adjustable [of the rotational frequency of the development sleeve 141].
[0053] A toner concentration control means detects the permeability of the developer with which it loaded into development counter 14A - 14D by the toner concentration sensor TS, and when this drives a toner makeup unit (not shown), it controls toner concentration to abbreviation regularity.
[0054] The program which constitutes a development nature fixed means by controlling the rotational frequency of the development sleeve 141 according to the patch toner image 1 which developed on the image support 10 By obtaining the development nature beyond the sensitization property of a sensitization layer, and controlling uniformly the toner concentration which is closely related to development nature The amount of the developer which controls the rotational frequency of the development sleeve 141 and adheres in the development field of image support 10 front face is changed, and the maximum image concentration is adjusted. The program which constitutes a development nature fixed means contains the device and control program which control the toner concentration in a developer tank uniformly, when adopting a two component developer. A/D converter 250 has connected the image concentration sensor C through amplifier 251. Amplifier 251 amplifies the output level from the image concentration sensor C on the driver voltage level of a microprocessor 210.
[0055] The image concentration sensor C forms in Casing CK a slot which makes the angle whose centers of the light-receiving side of the light emitting diode LED (light emitting diode LN66, the Kagoshima Matsushita electronic incorporated company make) and the photo transistor PT (the photo transistor PN 101, the Kagoshima Matsushita electronic incorporated company make) which emit light in infrared light are 40 degrees and 40 degrees, as shown in drawing 3 , and it inserts it in light emitting diode PD and a photo transistor PT in the slot concerned. The whole surface of Casing CK is prepared from image support 10 front face in the 6mm gap so that it may become level on the front face of the image support 10 and the center of the image support 10 may be countered near the cleaning unit 22. The image concentration sensor C constitutes phot coupling from light emitting diode LED and a photo transistor PT. Adjustable DC power supply Vref (not shown) of the maximum output 10 (V) are connected to the anode terminal of light emitting diode LED, and the semipermanent resistance element VR 1 (not shown) and the fixed-resistance element R8 (not shown) which can be switched to 1k (omega) and 2k (omega) are connected to the cathode terminal of light emitting diode LED. By making it such a configuration, adjustable [of the output voltage of adjustable DC power supply Vref] is carried out, and the luminescence reinforcement of light emitting diode LED is adjusted. DC power supply VDC of 10V are connected to the anode terminal of a photo transistor PT, and the output detector which consists of an operational amplifier IC (not shown) and fixed-resistance elements R5 and R6 (not shown) is established in the cathode terminal. Such a configuration detects the voltage according to the optical reinforcement which received light by phot galvanized iron JISUTA PT. It enables it to have received by this the light reflected from a toner image efficiently.
[0056] In addition, the decision method of the luminescence quantity of light of light emitting diode LED which constitutes the image concentration sensor C determines that it is set to V0 by the output voltage from the photo transistor PT which received the light which emits light and reflects light emitting diode LED from the image support 10 (condition that a toner has not adhered). The dirt of the protection-against-dust glass (not shown) which constitutes the image concentration sensor C by this, and image support 10 front face can be amended.
[0057] It is the mechanical configuration and electric configuration in image formation equipment of the above this example.
[0058] Here, the patch image adopted by this example is explained.
[0059] Drawing 4 is the mimetic diagram which expanded the patch image formed on image support.
[0060] A patch image is preceded with original image formation, and forms two or more patch images (refer to drawing 4) constituted with the toner image of line breadth with which each differed on the image support 10.
[0061] In drawing 4 , the arrow head shows the hand of cut of the image support 10, and the slash shows that the toner has adhered. The condition of drawing 4 (a) having shown five patch images, having fixed line breadth of the line which forms a patch image by 50 micrometers, and carrying out sequential change of the gap of 50 micrometers of a line, 75 micrometers, 100 micrometers, 125 micrometers, and the 150 micrometers is shown. Drawing 4 (b) shows five patch images, and the condition of having changed the line breadth of the line which forms a patch image so that it might become thin one by one with 100%, 80%, 60%, 40%, and 20% is shown. Actuation fundamental also in the monochrome of specification [the toner line image which forms the patch image concerned also in which patch image], or the secondary color which piled up two colors is the same. As for the thinnest thing of line breadth, in the toner line image which constitutes a patch image, it is desirable to set it as the size which does not overlap the toner image which adjoined each other even if it took all fluctuation expected into consideration. Even if the thickest thing of line breadth takes all fluctuation expected into consideration, it is desirable to set it as the size which overlaps the toner image which always adjoined each other. Moreover, as for the magnitude of a patch image, it is desirable to make it larger than the measuring range of a sensor in order to secure sensitivity.
[0062] Each of drawing 6 and drawing 7 is graphs which show the relation between reflection density and line spacing.
[0063] The graph shown in drawing 6 and drawing 7 shows the relation of the reflection density and pulse width which are obtained from the patch image shown in drawing 4 (a). The graph shown in drawing 7 shows the case where concentration is highly measured with dirt. In any case, it turns out that point of inflection b exists. Since the

regular reflection from the patch image shown in drawing 4 (a) is larger than the echo from a toner 10 or more times, in the process in which a toner image covers the front face of the image support 10, and goes like the field 1 of drawing 6 , its change is large. After a toner image covers all image support 10 front faces, it is shown that the change by the layer of a toner increasing turns into a loose change at the business of the field 2 of drawing 6 .
[0064] Each of drawing 8 and drawing 9 is graphs which show the relation between reflection density and pulse width.
[0065] The graph shown in drawing 8 and drawing 9 shows the relation of the reflection density and pulse width which are obtained from the patch image shown in drawing 4 (b). The graph shown in drawing 9 shows the case where there is sensitivity change of the image support by the environmental variation or secular change, from the graph shown in drawing 8 . In any case, it turns out that point of inflection a exists. Since the regular reflection from the patch image shown in drawing 4 (b) is larger than the echo from a toner 10 or more times, in the process in which a toner image covers the front face of the image support 10, and goes like the field 1 of drawing 8 , its change is large. After a toner image covers all image support 10 front faces, it is shown that the change by the layer of a toner increasing turns into a loose change at the business of the field 2 of drawing 8 .
[0066] Next, the line breadth control method in the image formation equipment of this example is explained.
[0067] Image formation equipment explains setting-out processing of the rotational frequency of the development sleeve 141 for obtaining the desired highest image concentration (1.4).
[0068] An operator sends out a copy initiation command to MPU210 from a control panel (not shown). MPU210 detects the phase of the image support 10 with the phasing signal outputted from an encoder (not shown), and rotates the image support 10 in the **** direction (reference, such as drawing 1) from the phase. MPU210 impresses predetermined output voltage to the electrification machine 12 from a high voltage power supply (not shown), and thereby, the electrification machine 12 starts discharge and is uniformly charged in the image formation field of the image support 10. Then, the output voltage of the source Vref of direct-current good transformation is set up so that it may be set to 7 (V) with the sensor output in the portion which changes the output voltage of adjustable DC power supply Vref to light emitting diode LED (refer to drawing 4) which constitutes the image concentration sensor C, and does not have a toner patch. It is made to oscillate with this applied voltage, and infrared light is irradiated at the image support 10. A patch image is formed on the image support 10. The exposure level at the time of creating a patch image at this time uses PWM255 which is the maximum light exposure. Thus, the created latent image is developed with the development sleeve 141 of a different rotational frequency. The rotational frequency of the development sleeve 141 is raised to 450rpm every 25rpm from 100rpm. And two or more patch images then created are read by the image concentration sensor C. It means that the rotational frequency of the development sleeve 141 is fixed when the output value read to sensor output 1.5V which are equivalent to 1.4 by fixation image concentration (Macbeth image concentration meter activity) becomes coincidence or an output not more than it, and the printer had secured 1.4 or more by the maximum image concentration. In addition, although based also on the properties (the amount of charges, toner concentration, fluidity, etc.) of a developer, and the surface potential property of a sensitization layer, the rotational frequency of the development sleeve 141 is fixed to about 225 rpm (the ratio of development sleeve lead ** / image support linear velocity is about 1.60) in ordinary temperature normal relative humidity (an equivalent for 20-degree-C50%RH).
[0069] MPU210 performs line breadth measurement processing which showed the width of face of a linear toner image in drawing 4 (b) in which it asks for line breadth indirectly from the reflection density of a patch image, following decision actuation of the rotational frequency of the development sleeve 141 mentioned above.
[0070] Specifically, MPU210 is sent out to the Pulse-Density-Modulation circuit (not shown) which constitutes write-in equipment 13 for a patch signal from RAM230 which constitutes an PWM control means. A Pulse-Density-Modulation circuit (not shown) sends out the modulating signal which carried out Pulse Density Modulation of the patch signal for 1 scan line to LD actuation circuit (not shown). LD actuation circuit -- a modulating signal -- semiconductor laser -- oscillation **** -- a laser beam is irradiated by things. It is made to deviate by the polygon mirror which rotates this laser beam at predetermined speed, and by ftheta lens, the 1st cylindrical lens, and the 2nd cylindrical lens, on the image support 10, it extracts to a minute spot and scans. The above latent-image formation actuation is repeated the number of predetermined times. MPU210 drives development counters 14A-14D in the location which synchronized with the electrostatic latent image, after detecting the phase of the image support 10 from the phasing signal sent out from an encoder (not shown), if termination of latent-image formation actuation is detected. Thereby, the latent image currently formed on the image support 10 develops two or more patch images shown in drawing 4 .
[0071] MPU210 detects the phase of the image support 10 from the phasing signal from an encoder, and it sets up the output voltage of the source Vref of direct-current good transformation so that the sensor output in the portion which changes the output voltage of adjustable DC power supply Vref to light emitting diode LED (refer to drawing 3) which constitutes the image concentration sensor C, and does not have a toner patch may be set to 7 (V). It is made to oscillate with this applied voltage, and infrared light is irradiated at the image support 10. Thereby, the photo transistor PT which constitutes the image concentration sensor C sends out the sensor output according to the optical reinforcement reflected from the patch image which developed on the image support 10 to MPU210 through A/D converter 251.
[0072] If the sensor output obtained from the patch image which developed 5.8 (V) Becomes, since the maximum output of a sensor will be 7V, MPU210 is image concentration. - Data is made up for and it is interpolating because 32 data of PWM 0-248 interpolates an operation like log5.8 (V)/7 (V). The method of the interpolation concerned

may adopt the method of common knowledge, such as a straight-line spline and the Lagrange straight line, or a interpolation method original with a layout top. Here, interpolation by the cubic spline function was performed (Kyoiku Shuppan: refer to a spline function and its application).

[0073] Since it fixed to 1.4 at the rotational frequency of the development sleeve 141, the maximum image concentration is the concentration operation value of the sensor output of the PWM level 255. - log (the sensor output of PWM255 level / 7 (V)) also needs to be 1.4. Since the sensor output of PWM255 of the sensor output on [PWM / 248] a property of image formation equipment is also almost the same, -log (the sensor output of PWM248 level / 7 (V)) also needs to be 1.4. Then, a printer property is acquired by normalizing the operation value of the obtained concentration by 1.4 of the maximum image concentration. However, since the image concentration on a transfer paper with the actual concentration of PWM0 has the concentration of a transfer paper, = (fixation image concentration got by the concentration meter) (concentration of the patch toner image on the image support obtained from a sensor output) is obtained by applying the concentration of a transfer paper to the acquired concentration operation value. In addition, you may make it MPU210 raise detection precision by reading two or more times to a patch image, and averaging the value.

[0074] Even if it changes and prints line width of face, it is necessary to determine the line width of face which has neither alphabetic character crushing nor alphabetic character **** by viewing, and generally in Japan using the kanji with many stroke counts, it is about 120 micrometers. Image formation equipments, such as a printer, are adjusted by electrification potential and the width of face of PWM so that it may become 120 micrometers by the standard operating environment in a shipment phase. However, the image reproduced to imprint material produces change to concentration and line width of face by aging of the image support 10 or a developer, and environmental change. Therefore, it is necessary to adjust electrification potential and PWM and to reset to initial value by measuring concentration and line width of face before a power up or printing initiation.

[0075] In the image formation equipment of this example, in order to consider as a good quality of printed character, MPU210 measures printing concentration, resets and sets a line pitch to 120 micrometers of initial value to initial value continuously, carries out sequential change of the PWM value, and it asks for point of inflection. That is, MPU210 asks for the intersection of the tangent of a parabola shown in drawing 8 as point of inflection a. The line breadth and the pitch of a toner image recognize as an equal the point of inflection a which calculated MPU210 as mentioned above. MPU210 calculates ** with the pulse width used for the patch image formation for obtaining the image concentration obtained as mentioned above. MPU210 computes the optimal pulse width from said point of inflection a.

[0076] Here, it depends for the calculation precision of point of inflection a only on the index signal for controlling the timing of the write-in means 13 of operation. Since the quartz resonator of high degree of accuracy etc. is used in order that the line breadth detection method in this example may acquire a reference signal, the calculation precision of point of inflection a is also maintained at high degree of accuracy. Therefore, since the line breadth measuring method of this example did not measure directly the absolute value or line breadth of reflection density which require high degree of accuracy of the image concentration sensor C but line breadth is detected using the signal of high degree of accuracy like an index signal, even if the line breadth control method in this example is the image concentration sensor C which does not require a high precision, it can detect line breadth using the signal of high degree of accuracy. Moreover, since the mounting precision of the image concentration sensor C of the line breadth control method in this example may also be rough, the adjustment routing counter of the image concentration sensor C can also be decreased. Moreover, according to the line breadth control method in this example, it is not influenced by the sensitivity lowering by the environmental variation or aging of the image concentration sensor C.

[0077] In addition, although it explained controlling MPU210 to adjust the pulse width signal for forming a latent image by making into initial value the PWM value recognized by the above-mentioned processing, it is not limited to this and you may make it adjust to the grid voltage of the electrification machine 12, the rotational frequency of development counters 14A-14D, and one process conditions of the development bias in this example. Moreover, control action is the same as the above-mentioned explanation about the patch image shown in drawing 4 (a).

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

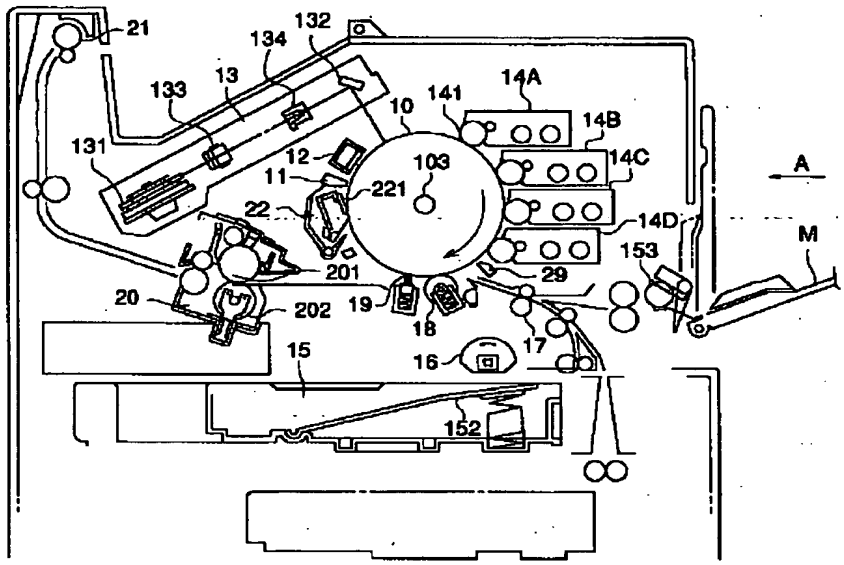
[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing the image formation equipment of this example.
[Drawing 2] It is the block diagram showing the control circuit in the image formation equipment of this example.
[Drawing 3] It is the perspective diagram showing the arrangement condition of the image concentration sensor C.
[Drawing 4] It is the mimetic diagram which expanded the patch image formed on image support.
[Drawing 5] It is the graph which shows the potential property of the image support adopted as the image formation equipment of this example.
[Drawing 6] It is the graph which shows the relation between reflection density and line spacing.
[Drawing 7] It is the graph which shows the relation between reflection density and line spacing.
[Drawing 8] It is the graph which shows the relation between reflection density and pulse width.
[Drawing 9] It is the graph which shows the relation between reflection density and pulse width.
[Drawing 10] It is the block diagram showing a line breadth measurement means to measure the line breadth of a toner image directly.
[Drawing 11] It is the block diagram showing a line breadth measurement means to measure the line breadth of a toner image indirectly.
[Drawing 12] It is a mimetic diagram explaining the phenomenon of changing the width of face of a linear toner image.
[Description of Notations]
10 Image Support
12 Electrification Machine
13 Write-in Equipment
14A-14D Development counter
C Image concentration sensor

[Translation done.]

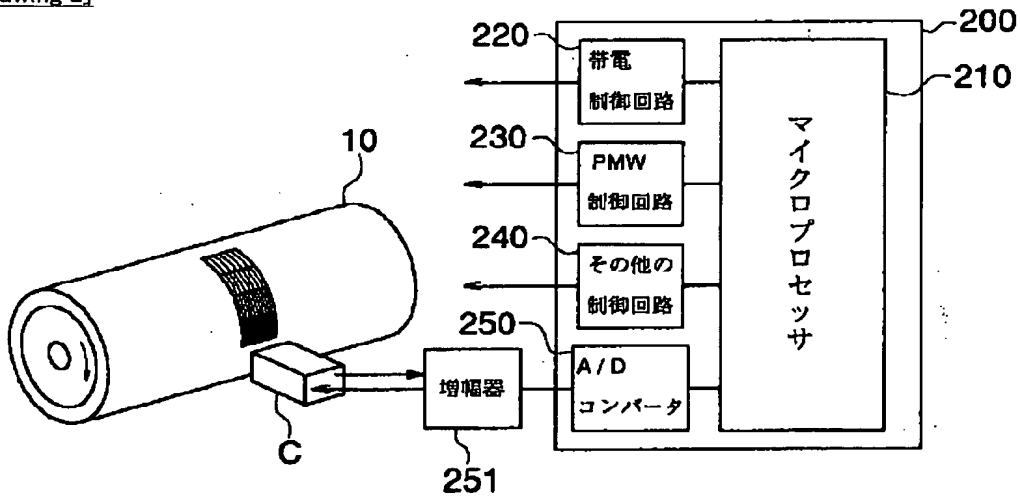
* NOTICES *

DRAWINGS

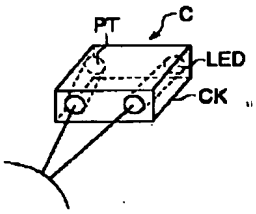
[Drawing 1]



[Drawing 2]

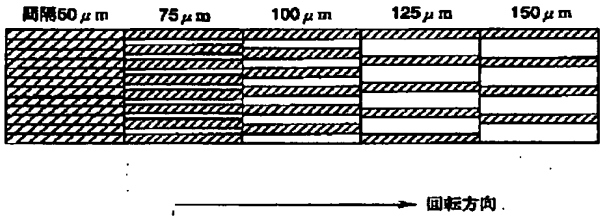


[Drawing 3]

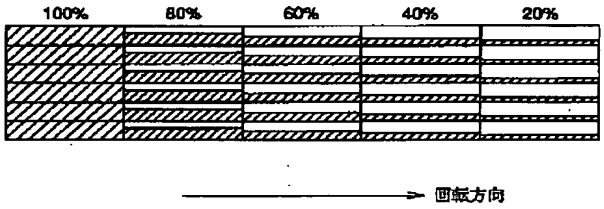


[Drawing 4]

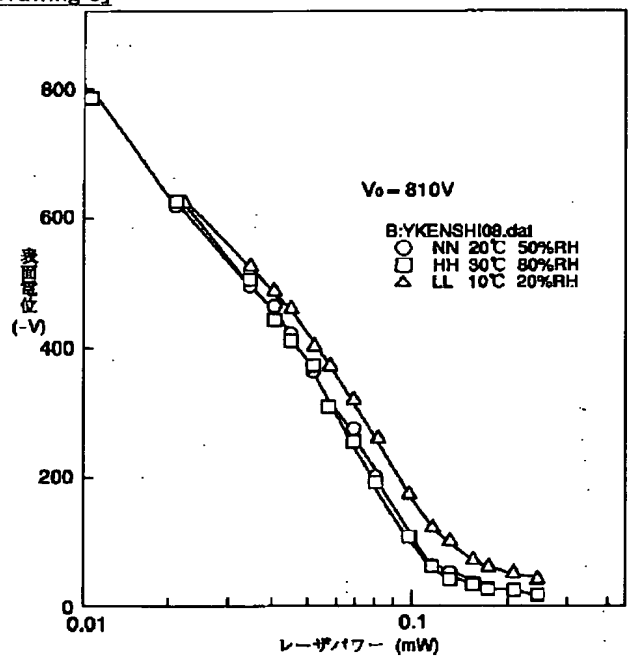
(a)



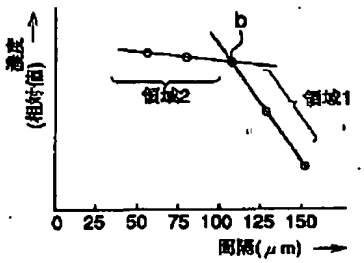
(b)



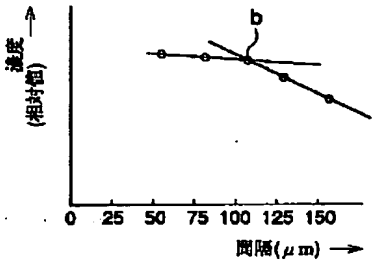
[Drawing 5]



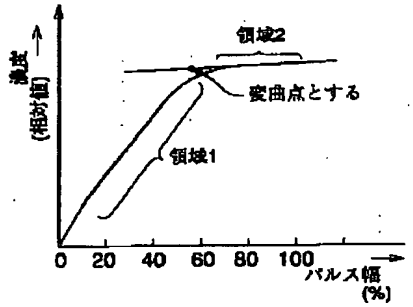
[Drawing 6]



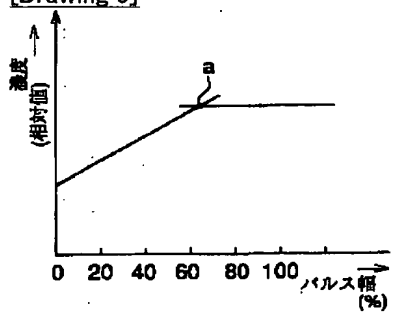
[Drawing 7]



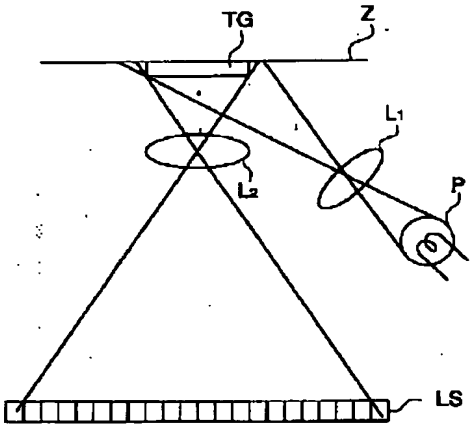
[Drawing 8]



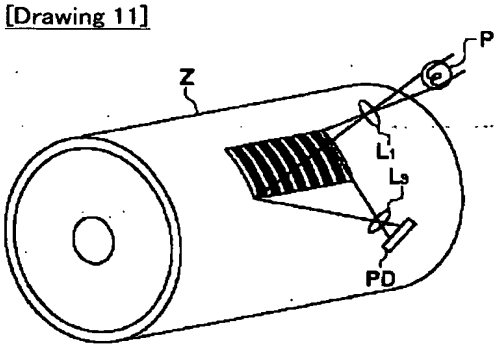
[Drawing 9]



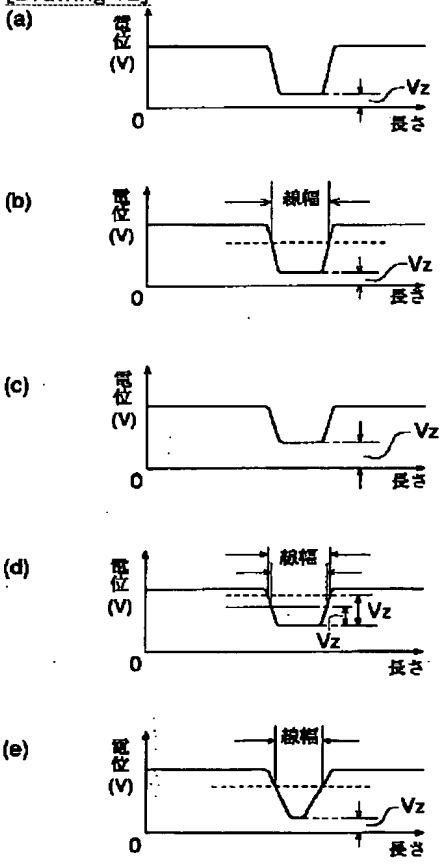
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]

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Ｈ０４Ｎ　1/29			Ｈ０４Ｎ　1/29	Ｄ	

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(71)出願人　000001270
コニカ株式会社
東京都新宿区西新宿１丁目26番２号

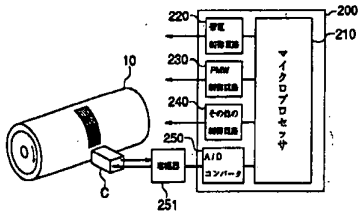
(72)発明者　堀内　立美
東京都八王子市石川町2970番地コニカ株式会社内

(54)【発明の名称】　線幅制御方法

(57)【要約】

【目的】　トナー線像の線幅を数μｍから１０μｍ程度で検出して再生するトナー線像を所定の線幅に制御する線幅制御方法を提供することにある。

【構成】　光源の発光を制御するパルス幅信号を調整するパルス幅制御工程と、光源から光を照射することにより複数のライン潜像からなるパッチ潜像を形成するパッチ潜像形成工程と、パッチ潜像をトナー線像からなるパッチ像に顕像化する顕像工程と、パルス幅制御工程から顕像工程を繰り返して階調の異なる複数のパッチ像を形成する工程、前記パッチ像の光学濃度を測定する工程と、前述したトナー線像とパッチ像からインデックス信号を用いて反射濃度の傾における変曲点を検出する変曲点検出工程と、前記変曲点におけるデータから電子写真プロセスの条件を調整するプロセス条件調整工程とからなる。



１

【特許請求の範囲】

【請求項１】　光源の発光を制御するパルス幅信号を調整するパルス幅制御工程と、前記光源から光を照射することにより複数のライン潜像からなるパッチ潜像を形成するパッチ潜像形成工程と、前記パッチ潜像をトナー線像からなるパッチ像に顕像化する顕像工程と、前記パルス幅制御工程から顕像工程を繰り返して階調の異なる複数のパッチ像を形成する工程、前記パッチ像の光学濃度を測定する工程と、前記トナー線像とパッチ像からインデックス信号を用いて反射濃度の傾における変曲点を検出する変曲点検出工程と、前記変曲点におけるデータから電子写真プロセスの条件を調整するプロセス条件調整工程とからなる線幅制御方法。

【請求項２】　前記パッチ像は複数色を重ね合わせたものであることを特徴とする請求項１記載の線幅制御方法。

【請求項３】　前記パッチ像はトナー線像の線幅を一定として間隔を変えたものであることを特徴とする請求項１または請求項２記載の線幅制御方法。

【請求項４】　前記パッチ像はトナー線像の線幅を変化させたものであることを特徴とする請求項１または請求項２記載の線幅制御方法。

【請求項５】　前記パッチ像の大きさは、センサの測定範囲より大きくしてあることを特徴とする請求項１または請求項２記載の線幅制御方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、電子写真プロセスで再現するライン線像の線幅を所定幅に調整する線幅制御方法に関する。

【０００２】

【従来の技術】電子写真プロセスを採用する画像形成装置において、再生した線像は画像環境の温度や湿度、像担持体や現像剤の使用回数等によって画像の濃度や線幅を変化する。像担持体上に反転現像によりトナー像を形成する画像形成装置において、線状のトナー像の幅が変動する現象を図１２を参照して説明する。

【０００３】図１２は線状のトナー像の幅が変動する現象を説明する模式図である。図１２（ａ）～（ｅ）は縦軸に電位をとり、横軸に長さを示したものであり、これによってトナー像の濃度と線幅を模式的に示したものであり、２点鎖線で示すV_Zは残留電位を示している。図１２（ａ）は像担持体を帯電した後に像露光して形成した潜像を示す模式図である。図１２（ｂ）は図１２（ａ）に示す潜像を現像したときトナー付着量に相当する部分を示したものであり、点線はトナーの表面電位を示している。図１２（ｃ）は繰り返し使用により残留電位V_Zが図１２（ａ）に示した初期状態から上昇した際の潜像電位を示す模式図である。図１２（ｄ）における一点鎖線は図１２（ｃ）に示す潜像を現像したときのトナー付着量に相当する部分を示したものである。かかる場合図１２（ｂ）に示したトナー像の線幅と殆ど変わらないが、画像濃度が低下することを示している。斯かる画像濃度の低下を補正するために現像条件を制御して現像したものが点線で示したものであり、画像濃度を同一にできることを示しているが、線幅が増加することを示している。図１２（ｅ）は像担持体の感光層のγ特性が緩やかな方向変化した状態を示すものであり、斯かる条件下で現像すると最大の画像濃度に変化はないが、線幅が狭くなることを示している。

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【０００４】前述した画像濃度や線幅の変化を抑えるために環境の温度や湿度を測定して、温度が高いときには帯電電位をより高く設定する等の補正やトナーパッチの反射濃度を測定することによりトナー像の線幅や画像濃度を検出してフィードバックする等が行われている。斯かる線幅測定手段には直接測定方式と間接測定方式が考えられる。

【０００５】図１０はトナー像の線幅を直接的に測定する線幅測定手段を示すブロック図である。

【０００６】斯かる直接測定方式の線幅測定手段は、光源Ｐからの光を像担持体Ｚに結像する結像レンズL_1と像担持体Ｚに担持したトナー像T_Cから反射する光を受光素子LSに拡大して結像する結像レンズL_2とを備え、受光素子LSからの出力信号をカウントすることにより、トナー像の線幅を検出することが考えられる。

【０００７】図１１はトナー像の線幅を間接的に測定する線幅測定手段を示すブロック図である。

【０００８】斯かる間接測定方式の線幅測定手段は、光源Ｐからの光を像担持体Ｚに結像する結像レンズL_1と像担持体Ｚに担持したトナー像T_Cから反射する光を受光素子PDに縮小して結像する結像レンズL_3とを備え、像担持体の表面を覆う被覆率の変化として捉え、単一の受光部を有する受光素子PDで反射光量の変化として検出するものである。ここで採用する受光素子PDは単一の受光部を有するもので足りるので、図１０に示したような直接線幅を測定する線幅測定手段よりも安価になる。

【０００９】

【発明が解決しようとする課題】しかしながら、上記帯電電位の補正やトナーパッチの反射濃度の測定によりフィードバックしたにも拘わらず、線幅の変化は数μｍから１０μｍ程度と小さいため安価な装置で直接測定できるものは無かった。具体的には、図１０に示したような線幅測定手段は、線幅の変動を精度良く検出するために一画素当たり数μ程度のピッチで形成したラインセンサを必要とし、受光素子L_2からなる光学系の倍率は１０倍程度の倍率を必要とすることになるので、コスト高となる。仮に前述の光学系の焦点距離を５㎜とすると、センサ全体は５０㎜以上の大きさとなるので、小型化する傾向にある画像形成装置に組み込みにくい大きさとなる。一方、図１１を参照して説明した線幅測定手段は、

トナー像を線状のトナー像が複数集まった形態として把握していることになるので、線幅の変化と画像濃度の変化を区別して測定できない。従って、現像条件等を調整して画像濃度を所定に維持できたとしても、受光素子PDからの出力レベルはトナー像の線幅と関係するので、環境変動や経時変化、汚れ等で出力も変化することになり、その誤差を補正することができなかった。又、いずれの方法もセンサの絶対的な精度を要求されるので、画像形成装置内に組み込んで使用できるものも無かった。また、ラインセンサを駆動するための回路とラインセンサからの出力信号を読み取る回路も複雑で高価になる。

【００１０】本発明の目的は、上記問題点に鑑み、トナー線像の線幅を数μmから１０μm程度で検出して再生するトナー線像を所定の線幅に制御する線幅制御方法を提供することにある。

【００１１】

【課題を解決するための手段】上記目的を達成する手段としては、以下のものがある。

【００１２】（１）　光源の発光を制御するパルス幅信号を調整するパルス幅制御工程と、前記光源から光を照射することにより複数のライン潜像からなるパッチ潜像を形成するパッチ潜像形成工程と、前記パッチ潜像をトナー線像からなるパッチ像に顕像化する顕像工程と、前記パルス幅制御工程から顕像工程を繰り返して階調の異なる複数のパッチ像を形成する工程、前記パッチ像の光学濃度を測定する工程と、前記トナー線像とパッチ像からインデックス信号を用いて反射濃度の傾斜における変曲点を検出する変曲点検出工程と、前記変曲点におけるデータから電子写真プロセスの条件を調整するプロセス条件調整工程とからなる線幅制御方法。

【００１３】（２）　前記パッチ像は複数色を重ね合わせたものであることを特徴とする（１）の線幅制御方法。

【００１４】（３）　前記パッチ像はトナー線像の線幅を一定として間隔を変えたものであることを特徴とする（１）、（２）のいずれかの線幅制御方法。

【００１５】（４）　前記パッチ像はトナー線像の線幅を変化させたものであることを特徴とする（１）、（２）のいずれかの線幅制御方法。

【００１６】（５）　前記パッチ像の大きさは、センサの測定範囲より大きくしてしてあることを特徴とする（１）、（２）のいずれかの線幅制御方法。

【００１７】

【実施例】図１は本実施例の画像形成装置を示す概略構成図であり、図５は本実施例の画像形成装置に採用する像担持体の電位特性を示すグラフである。

【００１８】本実施例の画像形成装置は、図１に示すように像担持体１０の１回転毎に帯電器１２による帯電し、書込装置１３による像露光により像担持体１０上に色分解した静電潜像を形成し、当該静電潜像をフルカラーで再現する為に像担持体１０の周縁にイエロー、マゼンタ、シアン、黒色のトナーとキャリアとから成る二成分現像剤をそれぞれ内蔵した現像器１４Ａ～１４Ｄから選択的に動作させてトナー像に顕像化し、当該トナー像を像担持体１０に形成する一連のプロセスを色毎に複数回繰り返すことにより、像担持体１上に各色トナー像を重ね合わせた後給紙カセット１５から送られてくる転写材へ転写ローラ１８により一括して転写された後定着装置２０により定着する。

【００１９】画像形成装置の本体筐体は直立した側面パネル１（図示せず）と側面パネル２（図示せず）とから形成してある。側面パネル１，２の間に書込装置１３と、像担持体１０と、複数の現像器１４Ａ～１４Ｄを収める現像ユニット１２０と、さらに定着装置２０と、ＤＣ電源ユニット（図示せず）が組み込まれ、一方側面パネル２の外側には駆動系とプリンターコマンドを解読するフォーマッター（図示せず）と機械の動作シーケンス制御用の制御基板（図示せず）が収められ、また現像ユニット１２０の上部には現像ユニット１２０内の各現像器１４Ａ～１４Ｄに接続するトナー補給手段１４０が収容される。

【００２０】像担持体１０、帯電器１２およびクリーニング装置２２はドラムカートリッジ１３０（図示せず）に組み込んで一体化してあり、一方各現像器１４Ａ～１４Ｄおよびトナー補給手段（図示せず）は架台１００（図示せず）に組み込んで一体化してある。架台１００は、画像形成動作を行える位置に位置決めしたり、或いは図１に示す如く装置本体に対する装着位置よりほぼ水平方向に移動してその引き出し位置に設定するための構成を備えている。

【００２１】装置本体を形成する側面パネル１と側面パネル２の各内面に上部レール５１（図示せず）と下部レール５２（図示せず）に相対するようにガイドローラ５３（図示せず）を設けてあり、一方架台１００はその左右の側面に、回動ローラ４２を備える板状部材４１を有し、回動ローラ４２をガイド部材５０に、板状部材４１自体をガイドローラ５３にそれぞれ係合して支持する。これが前述した機能を達成するための概略構成である。

【００２２】以下に各部材の構成及び機能に付いて説明する。

【００２３】像担持体１０は、アルミニュウムから成形したφ１２０の導電性支持体上に、例えばアルコール可溶性ポリイミドで膜厚０．３μmの下引き層を塗工し、当該下引き層上にＹ型チタルフタロシアニンをポリビニルブチラールを分散したＣＧＬ剤を塗布して膜厚０．３μmのＣＧＬを塗工し、当該ＣＧＬ上にポリカーボネートとスチルトリフェニルアミン系化合物からなる膜厚２５μmのＣＴＬを塗工して中間層、感光層を積層した電子写真感光体であり接地してある。像担持体１０の駆動軸１０３にエンコーダ（図示せず）を設けてあり、これによりＭＰＵ２１０は像担持体１０の位相を検出して電子写真プロセスを実行するようにしてある。

【００２４】ここで、像担持体１０の電位特性を図５を参照して説明する。

【００２５】図５に示したグラフは縦軸に像担持体１０の表面電位（－Ｖ）を示しており、横軸に半導体レーザのパワー（mW）を示してある。○は２０℃５０％ＲＨ（以下、これを常温常湿ＮＮということもある。）における電位特性を示したものであり、□は３０℃８０％ＲＨ（以下、これを高温高湿ＨＨということもある。）における電位特性を示したものであり、△は１０℃２０％ＲＨ（低温低湿ＬＬということもある。）における電位特性を示したものである。かかるグラフから環境の温度湿度によって像担持体１０の露光領域における表面電位が変動することが分かる。ここで、露光領域とは初期帯電電位以外の領域をいう。

【００２６】像担持体１０周面を支持する両フランジ１０１，１０２（図示せず）は駆動軸１０３と回転自在にしておき、駆動軸１０３に固定した固定部材１０４（図示せず）と一方のフランジ１０１との間にばね部材１０５を設けて互いを連結してある。このようにすると、像担持体１０と駆動軸１０３とからなる駆動系の剛性を低くしたのと同等の効果が得られ、固有振動数を下げて駆動歯車Ｇからの振動の変動と共振しないようにすることができる。そして、駆動軸１０３に入力された回転速度の変動を低剛性部材によって吸収させ、像担持体１０を１００mm／sec線速度の変動を生じさせずに回転させることができる。

【００２７】斯かる構成で駆動力伝達方法を実現することにより像担持体１０は安定した回転作動するので、ＰＣＬ１１は帯電器１２による負帯電に先だって、前プリントまでの感光体の履歴をなくすために発光ダイオード等を用いて露光を行って像担持体１０の感光層周面の除電する。帯電器１２は像担持体１０の周面に対してＶＧに電位保持されたグリッドと白金線（クラッド又はアロイ）からなるコロナ放電ワイヤからコロナ放電することによってＶＨ－８５０Ｖの一様な帯電を与える。

【００２８】書込装置１３は像担持体１０の感光層への一様帯電の後に画像信号に基づいて図示しないレーザダイオードを発光光源とし回転するポリゴンミラー１３１、ｆθレンズ１３３等を経て反射ミラー１３２により光路を曲げて走査して、像担持体１０の回転（副走査）によって潜像を形成するものである。つまり、フォーマッタからの画像データはレーザダイオード（ＬＤ）変調回路に送られて、変調された画像信号によりレーザダイオードが発光すると、そのビーム光はミラー１３７（図示せず）を介しビームインデックス１３６（図示せず）により各走査線の同期が図られてポリゴンミラー１３１に投射される。ポリゴンミラー１３１はその多面体でビーム光を反射して走査し、その走査光はｆθレンズ１３３、シリンドリカルレンズ１３４によりビーム形が補正されたあと反射ミラー１３２を介して感光体を露光して主走査を行い、静電画像を形成する。ポリゴンミラー１３１は６面鏡で回転数２３６００rpmのエアーベアリング採用する。ｆθレンズ１３３、シリンドリカルレンズ１３４等の焦点距離はｆ＝１４０mmである。ドットクロックは２０MHzである。ビーム径は約１４０×１００μmである。斯かるビーム径の潜像電位V_L－５０Ｖである。

【００２９】高品質画像を得るためにはトナーの粒径も小さくする必要がある。本実施例では各色とも８μmのサイズのトナーを使用している。ただしユーザにとって最も重要なのは黒色の文字品質であり、黒色トナーは小粒径トナー（７μm～１１μm）が好適である。これにより、画像形成装置の印字密度は主副ともに１２ｄｏｔ／ｍｍであり、ドットピッチは１／１２mmとしている。

【００３０】トナーボックス（図示せず）より供給されたトナーは現像器の右端部に落下され、相反する方向に回転する一対の撹拌スクリュによってキャリアと撹拌混合され、所定の帯電量（Ｑ／Ｍ）に設定される。

【００３１】一方トナー濃度はＬ検方式により検知され、この出力周波数にもとづいてトナーの供給量を制御して５ないし７％程度のトナー濃度値に設定制御される。

【００３２】撹拌された二成分現像剤は供給ローラ１４３を介して現像スリーブ１４１に搬送され、層厚規制部材（図示せず）によって薄層とされて像担持体１０の現像域に２０～３０mg／cm^{2}搬送され、次に記す現像条件によって静電潜像の反転現像を行う。

【００３３】現像域における現像スリーブ１４１と像担持体１０との間隙は層厚（現像剤）よりも大きい０．５mmとして、この間に２KV，８KHzのＡＣバイアスと－７５０VのＤＣバイアスが重畳して印加される。現像スリーブ１４１は像担持体１０に対して正転し、ＶＤＣとＶＨ、トナーの帯電は同極性であるため、ＶＡＣによってキャリアから離脱するきっかけを与えられたトナーはＶＤＣより電位の高いＶＨの部分には付着せず、ＶＤＣより電位の低いＶＬ部分に付着し顕像化（反転現像）が行われる。

【００３４】なお、図示しないが前記のトナーボックスに装填するトナーボトルをそのままトナーホッパとして使用することによりトナーの供給装置を小型簡略化すると同時に、トナーボトルを半透明の材料で成形することで残量を容易に視認出来るようにすることも可能である。

【００３５】転写材（図示せず）は給紙カセット１５内に片側基準で格納されており、従ってさばき爪１５１は転写材の基準面側にのみ設けられさらに半月ローラ１６も片持ち構造とされて転写材の基準面側に片寄って位置する。

【００３６】給紙部は、専用のモータ（図示せず）を有しており、半月ローラ１６が矢示方向に回転して押上げ板１５２上に積載した転写材をさばき爪１５１の作用によりその最上層の１枚のみを搬出する。

【００３７】給紙カセット１５より搬出された転写材は搬送系路に入ってUターンし、先端が給紙ローラ１７を通過したすぐ後に図示しない給紙センサの検知によってモータを一旦停止したのち、転写のタイミングが整った段階で再びモータが回転を始め、像担持体１０の感光層面に対し所定の角度を保ってその転写域に給紙される。

【００３８】一方手差しによる給紙は装置本体の前面に位置する手差し給紙台Mを図１の一点鎖線にて示す位置より実線にて示す位置に回動してセットして行う。

【００３９】手差しされた紙はピックアップローラ１５３の回転により搬送され、前述した給紙カセット１５からの給紙と同様のプロセスを経て転写域に給紙される。

【００４０】手差し給紙の対象とする紙は通常用いられる１６１ｂｓないし２４１ｂｓの一般の転写材Ｐの他、３６１ｂｓの厚紙やOHP用のトランスペアレンシ等である。また手差し給紙台Mを取り外し、オプションとして専用のフィーダを装着することで封筒の給紙も可能である。

【００４１】転写ローラ１８は像担持体１０の周面に対する位置が可変であって、単色画像のプリント時には常に圧接状態に置かれるが、カラー画像の形成中には退避して離間した位置に保たれ転写時にのみ圧接される。一方、分離ブラシ１９も転写ローラ１８の位置変動にほぼ同期して像担持体１０の周面に圧接ならびに離間の作動をする。斯かる転写ローラ１８に印加電圧が＋３ないし４KVDCで、ブレードによってローラ面をクリーニングする形式の転写ローラ１８が使用され、また分離ブラシ１９にはDCとACを重畳したバイアス電圧を印加して使用される。

【００４２】定着装置２０は、一対のローラから成るいわゆる熱ローラ方式の定着装置であって、ヒータHを内蔵し時計方向に駆動回転する上ローラ２０１と該上ローラ２０１に圧接して従動回転する下ローラ２０２との間に形成されたニップ部により転写材Ｐを加熱搬送してトナー像の溶着を行う。上下の各ローラは共に耐熱チューブを被覆されていて、圧接によりニップ部が直線状に形成されることにより、封筒等が搬送される際に生じ易い紙面のシワが防止される。上ローラ２０１の周面温度は温度センサSに検知されることによって制御されて所定の温度範囲内に保たれ、またトナーの溶着によって付着した汚れはクリーニングローラ２０３の圧接によって除去清掃される。このクリーニングローラ２０３はプリント枚数４万枚程度で新規のものに交換される。また、定着ヒータは使用しない時間が所定時間を越えるとSLEEPモードとなり、省エネ制御される。

【００４３】さらにOHPに使用されるトランスペアレンシを転写材として使用する場合、カラーのトナー像の透過率を向上するべくトナー像面を平滑化して乱反射を防止する目的から、上ローラ２０１の周面のオイルパッド２０４によりローラ表面にシリコンオイルが塗布される。

【００４４】従って本実施例の装置は転写材の搬送速度を１００㎜／sec，５０㎜／secおよび１２．５㎜／secの３段階に切換可能とすることにより、普通紙，封筒およびトランスペアレンシの３種の転写材を使用出来るモードを備えて幅広い用途に対応して利用される。

【００４５】なお、上ローラ２０１の設定温度は、低温度で溶融するトナーを用いることにより約１８０℃前後と低温度化することが可能であり、またオイルパッド２０４にスポンジ材（多孔質ＰＴＦＥ被覆）を用いることにより押圧ムラが解消されて均一なオイル塗布が実現される。

【００４６】以上が本実施例における画像形成装置の概略構成である。

【００４７】次に画像形成装置の制御回路について説明する。

【００４８】図２は本実施例の画像形成装置における制御回路を示すブロック図であり、図３は画像濃度センサCの配設状態を示す斜視図である。

【００４９】制御回路２００は、図２に示すようにマイクロプロセッサ２１０（以下に、MPUと略称する）とA／Dコンバータ２５０と、帯電制御用のプログラムを書き込んだRAM２２０、PWM制御を実行するプログラムモジュールを書き込んだRAM２３０とその他の静電写真プロセスを実行するためのプログラムモジュールを書き込んだRAM２４０と現像性固定手段を構成するプログラムを書き込んだRAM（図示せず）と、プリンタ特性検知手段及び最高画像濃度換算手段を構成するプログラムを書き込んだRAMを備えるものである。MPU２１０は撹拌スクリュウを駆動するためのソレノイドにドライバ（図示せず）を介して接続してある。

【００５０】プリンタ特性検知手段は、画像濃度センサCとMPU２１０及びテストパッチ信号S_Gを書き込んだRAM２３０から構成したものであり、実際のプリンタ特性及びそれから最高画像濃度を検出するものである。当該プログラムは最高画像濃度換算手段に相当するプログラムも含んでいる。

【００５１】画像濃度検出手段に相当するプログラムは、輝度信号をA／D変換することにより２５６階調に正規化した出力電圧に対する画像濃度センサCの定格最大出力（像担持体上に何も付着しない状態での出力）との比を対数変換した値に像担持体１０の濃度と転写紙の濃度との相違を考慮して画像濃度信号を得るものであり、像担持体１０の回転中に生ずる振動に起因する検出誤差を除去するために例えば像担持体１０上に顕像化した複数のパッチ像から得られる輝度信号に所定の処理を

施して平均した値を算出する（特開平1-41375号公報参照）。これにより、MPU２１０は像担持体１０の振動に起因する検出誤差を除去したプリンタ特性及び最大画像濃度を検知できることになる。

【００５２】MPU２１０は、透磁率の変化により現像性に関係なく、トナー濃度を一定に制御するトナー濃度制御系であって、像担持体の現像量を光学的に検出する手段のように感光層の感度特性の変化に影響されない為に現像スリーブ１４１の回転数を可変することにより反転現像方法における現像性を一定に担保する。

【００５３】トナー濃度制御手段は、現像器１４A～１４D内に装填した現像剤の透磁率をトナー濃度センサTSで検出し、これによりトナー補給ユニット（図示せず）を駆動することによりトナー濃度を略一定に制御するものである。

【００５４】現像性固定手段を構成するプログラムは、像担持体１０上に顕像化したパッチトナー像１に応じて現像スリーブ１４１の回転数を制御することにより、感光層の感光特性を越えた現像性を得るようにするものであり、現像性と密接に関係するトナー濃度を一定に制御することにより、現像スリーブ１４１の回転数を制御して像担持体１０表面の現像領域において付着する現像剤の量を変化させて最大画像濃度を調整する。現像性固定手段を構成するプログラムは、二成分現像剤を採用する場合、現像槽内のトナー濃度を一定に制御する機構及び制御プログラムを含むものである。A／Dコンバータ２５０は増幅器２５１を介して画像濃度センサCを接続してある。増幅器２５１は画像濃度センサCからの出力レベルをマイクロプロセッサ２１０の駆動電圧レベルに増幅するものである。

【００５５】画像濃度センサCは、図３に示すように赤外光を発光する発光ダイオードLED（発光ダイオードLN66、鹿児島松下電子株式会社製）とホトトランジスタPT（ホトトランジスタPN101、鹿児島松下電子株式会社製）との受光面の中心が４０°，４０°の角度をなすような様をケーシングCKに形成し、当該様に発光ダイオードPD及びホトトランジスタPTに嵌入したものである。ケーシングCKの全面は、像担持体１０の表面に水平になるようにクリーニングユニット２２の近傍に像担持体１０の中心に対向するように像担持体１０表面から６㎜の間隙で設けてある。画像濃度センサCは、発光ダイオードLEDとホトトランジスタPTとでホトカップリングを構成している。発光ダイオードLEDのアノード端子には最大出力１０(V)の可変直流電源V_{ref}（図示せず）を接続してあり、発光ダイオードLEDのカソード端子には例えば１k(Ω)と２k(Ω)とに切り換え可能な半固定抵抗素子VR1（図示せず）と固定抵抗素子Ｒ８（図示せず）を接続してある。このような構成にすることにより、可変直流電源V_{ref}の出力電圧を可変して発光ダイオードLEDの発光強度を調整するようにしてある。ホトトランジスタPTのアノード端子には10Vの直流電源V_{DC}を接続し、カソード端子にはオペアンプＩＣ（図示せず）と固定抵抗素子Ｒ５，Ｒ６（図示せず）とから構成される出力検出回路を設けてある。このような構成により、ホトトランジスタPTで受光した光強度に応じた電圧を検出するものである。これにより、トナー像から反射する光を効率良く受光できるようにしてある。

【００５６】なお、画像濃度センサCを構成する発光ダイオードLEDの発光光量の決定方法は発光ダイオードLEDを発光して像担持体１０（トナーの付着していない状態）から反射する光を受光したホトトランジスタPTからの出力電圧をV_0となるように決定する。これにより画像濃度センサCを構成する防塵ガラス（図示せず）及び像担持体１０表面の汚れを補正することができる。

【００５７】以上の本実施例の画像形成装置における機械的構成及び電気的構成である。

【００５８】ここで、本実施例で採用するパッチ像を説明する。

【００５９】図４は像担持体上に形成するパッチ像を拡大した模式図である。

【００６０】パッチ像は、本来の画像形成に先行して、各々が異なった線幅のトナー像によって構成した複数のパッチ像（図４参照）を像担持体１０上に形成するものである。

【００６１】図４において、矢印は像担持体１０の回転方向を示しており、斜線はトナーが付着していることを示している。図４（ａ）は５つのパッチ像を示したものであり、パッチ像を形成する線の線幅を５０μmで一定にして線の間隔５０μm，７５μm，１００μm，１２５μm，１５０μmを順次変化させた状態を示しており、図４（ｂ）も５つのパッチ像を示したものであり、パッチ像を形成する線の線幅を１００%，８０%，６０%，４０%，２０%と順次細くなるように変化させた状態を示している。いずれのパッチ像においても当該パッチ像を形成するトナー線像は特定の単色でも、２つの色を重ね合わせた二次色でも、基本的な動作は同じである。パッチ像を構成するトナー線像の中で、線幅の最も細いものは、予想されるすべての変動を考慮しても隣り合ったトナー像と重なり合わない太さに設定するのが好ましい。線幅の最も太いものは、予想される全ての変動を考慮しても、常に隣り合ったトナー像と重なり合っている太さに設定することが好ましい。又、パッチ像の大きさは感度を確保するため、センサの測定範囲より大きくしておくことが望ましい。

【００６２】図６及び図７はいずれも反射濃度と線間隔との関係を示すグラフである。

【００６３】図６及び図７に示すグラフは図４（ａ）に示したパッチ像から得られる反射濃度とパルス幅との関係を示したものである。図７に示すグラフは汚れによって濃度が高く測定された場合を示すものである。いずれ

の場合も変曲点ｂが存在していることが分かる。図４（ａ）に示したパッチ像からの正反射はトナーからの反射よりも１０倍以上大きいので、図６の領域１のようにトナー像が像担持体１０の表面を覆い隠して行く過程では変化が大きい。トナー像が像担持体１０表面を覆い尽くした後では、トナーの層が増加することによる変化は図６の領域２の用に緩やかな変化となることを示している。

【００６４】図８及び図９はいずれも反射濃度とパルス幅との関係を示すグラフである。

【００６５】図８及び図９に示すグラフは図４（ｂ）に示したパッチ像から得られる反射濃度とパルス幅との関係を示したものである。図９に示すグラフは図８に示したグラフから環境変化や経年変化による像担持体の感度変化のあった場合を示している。いずれの場合も変曲点ａが存在していることが分かる。図４（ｂ）に示したパッチ像からの正反射はトナーからの反射よりも１０倍以上大きいので、図８の領域１のようにトナー像が像担持体１０の表面を覆い隠して行く過程では変化が大きい。トナー像が像担持体１０表面を覆い尽くした後では、トナーの層が増加することによる変化は図８の領域２の用に緩やかな変化となることを示している。

【００６６】次に本実施例の画像形成装置における線幅制御方法を説明する。

【００６７】画像形成装置は所望の最高画像濃度（１．４）を得るための現像スリーブ１４１の回転数の設定処理を説明する。

【００６８】オペレータは操作パネル（図示せず）からコピー開始指令をＭＰＵ２１０に送出する。ＭＰＵ２１０は、エンコーダ（図示せず）から出力される位相信号により像担持体１０の位相を検出し、その位相から像担持体１０を矢示方向（図１等参照）に回転させる。ＭＰＵ２１０は高圧電源（図示せず）から所定の出力電圧を帯電器１２に印加し、これにより帯電器１２は放電を開始して像担持体１０の画像形成領域を一様に帯電する。引き続き、画像濃度センサＣを構成する発光ダイオードLED（図４参照）に可変直流電源V_{ref}の出力電圧を変化させてトナーパッチのない部分でのセンサ出力で７（Ｖ）になるように直流可変電源V_{ref}の出力電圧を設定する。この印加電圧で発振させて赤外光を像担持体１０に照射する。パッチ像を像担持体１０上に形成する。このときパッチ像を作成する際の露光レベルは最大露光量であるＰＷＭ２５５を使用する。このようにして作成された潜像を異なる回転数の現像スリーブ１４１で現像する。現像スリーブ１４１の回転数は１００ｒｐｍから２５ｒｐｍごとに４５０ｒｐｍまで上昇させる。そして、そのとき作成される複数のパッチ像を画像濃度センサＣで読み取る。定着画像濃度（マクベス社製画像濃度計使用）で１．４に相当するセンサ出力１．５Ｖに読んだ出力値が一致又はそれ以下の出力となったときに現像スリーブ１４１の回転数が固定され、プリンタは最大画像濃度で１．４以上を確保したことになる。なお、現像剤の特性（電荷量、トナー濃度、流動性等）、感光層の表面電位特性にもよるが常温常湿（２０℃５０％ＲＨ相当）では現像スリーブ１４１の回転数は約２２５ｒｐｍ（現像スリーブ線速／像担持体線速の比は１．６０程度）に固定される。

【００６９】ＭＰＵ２１０は、前述した現像スリーブ１４１の回転数の決定動作に続いて、線状のトナー像の幅を図４（ｂ）に示したパッチ像の反射濃度から間接的に線幅を求める線幅測定処理を実行する。

【００７０】具体的には、ＭＰＵ２１０はＰＷＭ制御手段を構成するＲＡＭ２３０からパッチ信号を書込装置１３を構成するパルス幅変調回路（図示せず）に送出する。パルス幅変調回路（図示せず）は１走査ライン分のパッチ信号をパルス幅変調した変調信号をＬＤ駆動回路（図示せず）に送出する。ＬＤ駆動回路は変調信号で半導体レーザを発振させることによりレーザビームを照射する。このレーザ光を所定速度で回転するポリゴンミラーで偏向させ、ｆθレンズ及び第１のシリンドリカルレンズ及び第２のシリンドリカルレンズによって像担持体１０上に微小なスポットに絞って走査する。以上の潜像形成動作を所定回数繰り返す。ＭＰＵ２１０は潜像形成動作の終了を検知すると、エンコーダ（図示せず）から送出される位相信号から像担持体１０の位相を検知した後に、静電潜像と同期した位置で現像器１４Ａ～１４Ｄを駆動する。これにより、像担持体１０上に形成してある潜像は図４に示す複数のパッチ像を顕像化する。

【００７１】ＭＰＵ２１０は、エンコーダからの位相信号から像担持体１０の位相を検知し、画像濃度センサＣを構成する発光ダイオードLED（図３参照）に可変直流電源V_{ref}の出力電圧を変化させてトナーパッチのない部分でのセンサ出力が７（Ｖ）になるように直流可変電源V_{ref}の出力電圧を設定する。この印加電圧で発振させて赤外光を像担持体１０に照射する。これにより、画像濃度センサＣを構成するホトトランジスタPTは像担持体１０上に顕像化したパッチ像から反射する光強度に応じたセンサ出力をＡ／Ｄコンバータ２５１を通してＭＰＵ２１０に送出する。

【００７２】ＭＰＵ２１０は顕像化したパッチ像から得られるセンサ出力が5.8(Ｖ)ならば、センサの最大出力は７Ｖであるから画像濃度は－ｌｏｇ5.8(Ｖ)／７(Ｖ)のような演算をＰＷＭ０～２４８の３２個のデータは補間することでデータの穴埋めを行って補間している。当該補間の方法は直線スプライン、ラグランジュ直線等周知の方式又は設計上独自の補間方式を採用する場合がある。ここでは３次スプライン関数による補間を行った（教育出版：スプライン関数とその応用参照）。

【００７３】最大画像濃度は現像スリーブ１４１の回転数によって１．４に固定したため、PWMレベル２５５のセンサ出力の濃度演算値－ｌｏｇ（ＰＷＭ２５５レベルのセンサ出力／７（Ｖ））も１．４である必要がある。画像形成装置の特性上ＰＷＭ２４８のセンサ出力もＰＷＭ２５５のセンサ出力もほぼ同じであるため、－ｌｏｇ（ＰＷＭ２４８レベルのセンサ出力／７(Ｖ)）も１．４である必要がある。そこで、得られた濃度の演算値を最大画像濃度の１．４で正規化することでプリンタ特性が得られる。しかし、ＰＷＭ０の濃度は実際の転写紙上の画像濃度は転写紙の濃度を有するため、得られた濃度演算値に転写紙の濃度を加えることにより（濃度計によって得られる定着画像濃度）＝（センサ出力から得られる像担持体上のパッチトナー像の濃度）が得られる。なお、ＭＰＵ２１０はパッチ像に対して複数回読んでその値を平均することで検出精度を上げるようにしてもよい。

【００７４】画数の多い漢字を用いる日本などではライン幅を変えて印字しても目視により文字つぶれや文字ぎれの無い、ライン幅を決定する必要があり、一般に１２０μｍ程度である。プリンタ等の画像形成装置は出荷段階で標準的な使用環境で１２０μｍとなるように帯電電位とＰＷＭの幅で調整している。しかしながら、転写材に再生した画像は像担持体１０や現像剤の経時変化、環境の変化により濃度とライン幅に変化を生じる。従って、電源投入時や印字開始前に濃度とライン幅を測定することにより、帯電電位、ＰＷＭを調整して初期値にリセットする必要がある。

【００７５】本実施例の画像形成装置において、ＭＰＵ２１０は良好な印字品質とするために印字濃度を測定して初期値にリセットし、続いてラインピッチを初期値の１２０μｍにしてＰＷＭ値を順次変化させて、変曲点を求める。つまり、ＭＰＵ２１０は図８に示す放物線の接線の交点を変曲点ａとして求める。ＭＰＵ２１０は前述のようにして求めた変曲点ａをトナー像の線幅とピッチとが等しいものとして認識する。ＭＰＵ２１０は、前述のようにして得られた画像濃度を得るためのパッチ像形成に使用したパルス幅との傾を計算する。ＭＰＵ２１０は前記変曲点ａから最適なパルス幅を算出する。

【００７６】ここで、変曲点ａの算出精度は書込手段１３の動作タイミングを制御するためのインデックス信号のみに依存する。本実施例における線幅検出方法は基準信号を得るために高精度の水晶振動子等を用いているので、変曲点ａの算出精度も高精度に保たれる。従って、本実施例の線幅測定方法は画像濃度センサＣに高精度を要求する反射濃度の絶対値や線幅を直接測定しておらず、インデックス信号のように高精度の信号を用いて線幅を検出しているので、本実施例における線幅制御方法は高い精度を要しない画像濃度センサＣであっても高精度の信号を使用して線幅を検出することができる。また、本実施例における線幅制御方法は画像濃度センサＣの取付精度もラフでよいので、画像濃度センサＣの調整工程数も減少させることができる。また、本実施例における線幅制御方法によれば、像濃度センサＣの環境変動や経時変化による感度低下に影響されない。

【００７７】なお、本実施例において、ＭＰＵ２１０は前述の処理で認識したＰＷＭ値を初期値として潜像を形成するためのパルス幅信号を調整するように制御することを説明したが、これに限定されるものでなく、帯電器１２のグリッド電圧、現像器１４Ａ～１４Ｄの回転数、現像バイアスのいずれかのプロセス条件に調整するようにしてもよい。また、図４（ａ）に示したパッチ像について制御動作も前述の説明と同様である。

【００７８】

【発明の効果】請求項１と請求項３、４記載の発明は、上記構成を備えることにより、トナー線像の線幅を数μｍから１０μｍ程度で検出して再生するトナー線像を所定の線幅に制御する線幅制御方法が提供されることとなった。また、請求項１と請求項３、４記載の発明は、インデックス信号のように高精度の信号を用いて線幅を検出しているので、高精度でない画像濃度センサであっても高精度の信号を使用して線幅を検出することができる。また、請求項１と請求項３、４記載の発明は画像濃度センサＣの取付精度もラフでよいので、濃度センサの調整工程数も減少させることができ、濃度センサの環境変動や経時変化による感度低下に影響されない。

【００７９】請求項２～４記載の発明は、上記構成を備えることにより、前記効果に加えてカラー画像形成プロセスを採用する画像形成装置にも適用できる線幅制御方法が提供されることとなった。

【００８０】請求項５記載の発明は、上記構成を備えることにより、前記の効果に加えてセンサの感度を高くすることができる線幅制御方法が提供されることとなった。

【図面の簡単な説明】

【図１】本実施例の画像形成装置を示す概略構成図である。

【図２】本実施例の画像形成装置における制御回路を示すブロック図である。

【図３】画像濃度センサＣの配設状態を示す斜視図である。

【図４】像担持体上に形成するパッチ像を拡大した模式図である。

【図５】本実施例の画像形成装置に採用する像担持体の電位特性を示すグラフである。

【図６】反射濃度と線間隔との関係を示すグラフである。

【図７】反射濃度と線間隔との関係を示すグラフである。

【図８】反射濃度とパルス幅との関係を示すグラフである。

【図９】反射濃度とパルス幅との関係を示すグラフであ

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る。

【図１０】トナー像の線幅を直接的に測定する線幅測定手段を示すブロック図である。

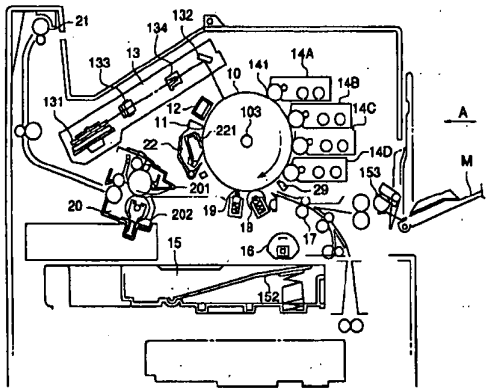
【図１１】トナー像の線幅を間接的に測定する線幅測定手段を示すブロック図である。

【図１２】線状のトナー像の幅が変動する現象を説明する模式図である。

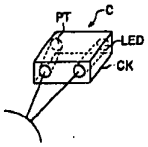
【符号の説明】

１０　像担持体
１２　帯電器
１３　書込装置
１４Ａ～１４Ｄ　現像器
Ｃ　画像濃度センサ

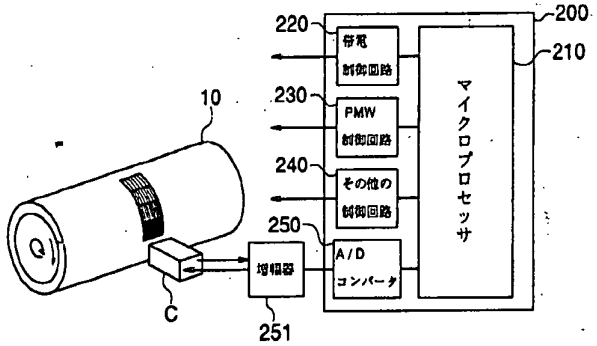
【図１】



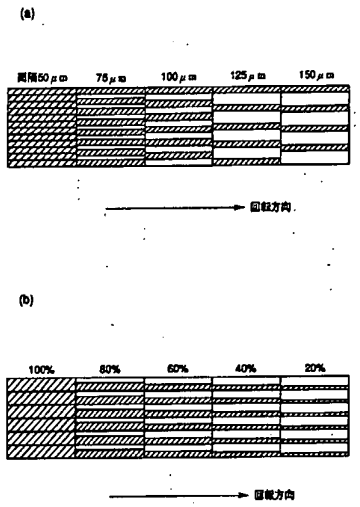
【図３】



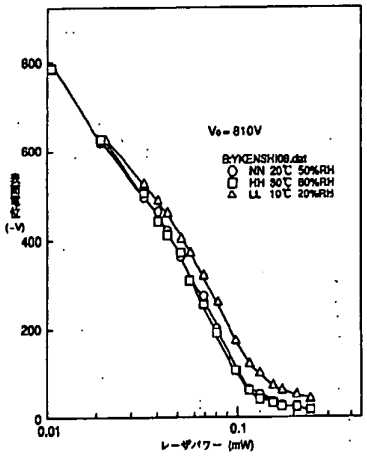
【図２】



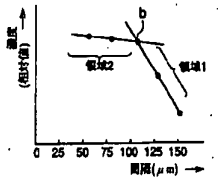
【図４】



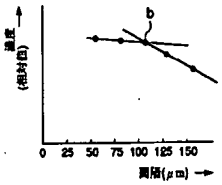
【図５】



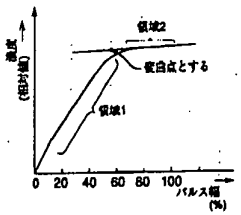
【図６】



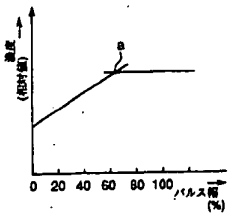
【図７】



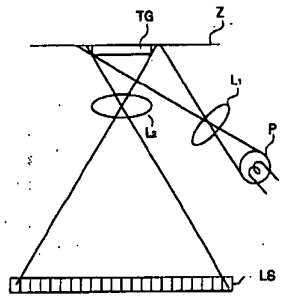
【図８】



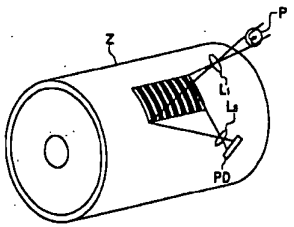
【図９】



【図10】



【図11】



【図12】